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ABSTRACT

This kit was developed by the Illinois Department of Conservation's Education Program with assistance from the State Board of Education, as a teaching tool which can be used to promote conservation awareness of young people. It is designed to enable educators to help students in grades 7-10 learn about Illinois' renewable natural resources through a variety of approaches including student lessons, a videotape, full-color posters, stand-alone activities, and a supplemental learning unit. Materials can correlate with current activities and assist in meeting State goals for Learning in several of the fundamental learning areas. Topics covered in the lesson plans include: natural resources; ecosystems; management of natural resources; values and principles; conflicts, resolutions, and planning; legislation and enforcement; species management; habitat management; and taking action. Activities include: construction of an aquarium or terrarium, censuses and estimates, resolving problems, values and principles, environmental assessment, turkey trouble, a prairie web of life, topographic maps, taking a survey, and American conservationists. Student and teachers' guides to an educational simulation game are included. (JRH)

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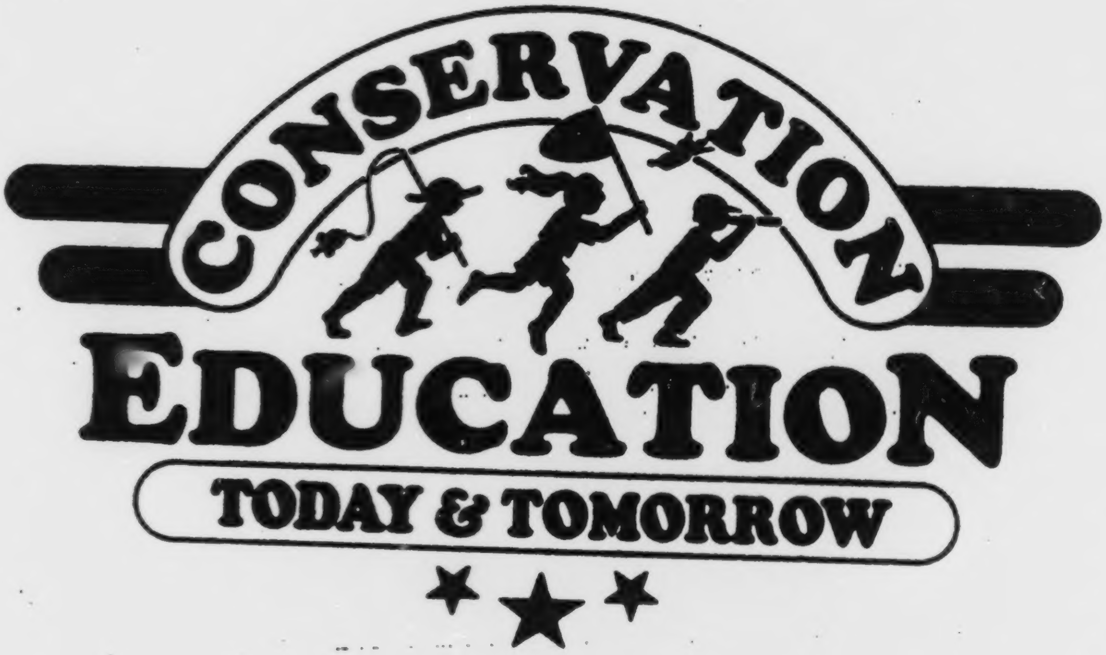

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Resource Conservation

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Illinois Department of Conservation
LINCOLN TOWER PLAZA • 524 SOUTH SECOND STREET • SPRINGFIELD 62701-1787 CHICAGO OFFICE • ROOM 4-300 • 100 WEST RANDOLPH • CHICAGO 60601
Brent Manning, Director John W. Comerio, Deputy Director Bruce F. Clay, Assistant Director

Dear Principal:

We are pleased to enclose the Conservation Education Program's *Resource Conservation* education kit. This is the fourth in a series of kits being developed to supplement conservation education activities in Illinois classrooms. The kit, developed by the Department of Conservation's Education Program with assistance by the State Board of Education, is a teaching tool which can be used to promote conservation awareness of young people. It is the fourth such cooperative endeavor between our agencies, and we hope it will serve as a model for similar cooperative educational projects among state agencies.

This unique conservation unit is designed to enable educators to help students learn about Illinois' renewable natural resources through a variety of approaches including student lessons; a videotape; a two-sided, full-color poster; stand-alone activities; and a supplemental learning unit. Materials can correlate with current activities and assist in meeting State Goals for Learning in several of the fundamental learning areas. The kit contains a variety of materials which lend themselves to concurrent use by teachers of grades 7-10 when housed in their learning center or library.

It is our hope that the *Resource Conservation* kit will be a useful supplement to conservation activities which are already being taught in your school. Other Conservation Education Program kits are being developed, including one on aquatic resources scheduled for release next school year. For more information about the program, feel free to contact the Department of Conservation's Education Program at 217/524-4126.

Sincerely,

Brent Manning
Brent Manning
Director
Illinois Department of Conservation

Joseph A Spagnolo
Joseph A. Spagnolo
State Superintendent of Education
Illinois State Board of Education

cc: Regional Superintendents
Superintendents

STOP

(Remember, this kit includes **original** masters! Please **photocopy** them for classroom use to keep this kit complete.)
MAKE SURE THIS KIT CONTAINS THE FOLLOWING ITEMS IN THE ORDER INDICATED:

Front Pocket Containing Originals:

- Rural/Urban Poster (two-sided, full-color)
- Natural Resources Role Playing
- Environmental Timeline
- Design a Resource Management Area
- Take Action Poster (black and white)

Acknowledgement Receipt Form (PLEASE RETURN PROMPTLY)

Introduction

Dear Educator Letter
Acknowledgements
State Goals for Learning

10 Lesson Plans

UNIT 1

What Are Natural Resources?
What Is An Ecosystem?
Why Manage Natural Resources?
Who Are the Users?

UNIT 2

Values and Principles
Conflicts, Resolutions and Planning
Legislation and Enforcement

UNIT 3

Species Management
Habitat Management
Taking Action

UNIT 4 (activities)

Construction of an Aquarium or Terrarium
Censuses and Estimates
Resolving Problems
Values and Principles
Environmental Assessment
Turkey Trouble
A Prairie Web of Life
Topographic Maps
Taking A Survey
American Conservationists

Glossary

A Closer Look

References and Additional Sources
Environmental Careers
Natural Resource Quotes
Projects WILD, Aquatic WILD and Learning Tree Activities
Urban/Rural Poster Interpretation

People, Animals And The Environment: An Educational Simulation Game

Resource Conservation Videotape

TABLE OF CONTENTS

Front Pocket Containing Originals
Rural/Urban Poster (two-sided, full-color)
Natural Resources Role Playing
Environmental Timeline
Design a Resource Management Area
Take Action Poster (black and white)

Page

Introduction

Dear Educator Letter....i
Acknowledgements....ii
State Goals for Learning....iii

10 Lesson Plans

UNIT 1

What Are Natural Resources?....1
What Is An Ecosystem?....3
Why Manage Natural Resources?....5
Who Are the Users?....7

UNIT 2

Values and Principles....9
Conflicts, Resolutions and Planning....11
Legislation and Enforcement....13

UNIT 3

Species Management....15
Habitat Management....21
Taking Action....35

UNIT 4 (activities)

Construction of an Aquarium or Terrarium....37
Censuses and Estimates....39
Resolving Problems....41
American Conservationists....42
Values and Principles....43
Environmental Assessment....45
Turkey Trouble....47
A Prairie Web of Life....51
Topographic Maps....53
Taking A Survey....57

Glossary....59

A Closer Look

References and Additional Sources....67
Environmental Careers....73
Natural Resource Quotes....75
Projects WILD, WILD Aquatic and Learning Tree Activities....83
Urban/Rural Poster Interpretation....101

People, Animals And The Environment: An Educational Simulation Game

Resource Conservation Videotape

CONSERVATION EDUCATION
TODAY & TOMORROW

Dear Educator:

In an effort to introduce students in grades seven through ten to the state's wealth of natural resources, the Illinois Department of Conservation is pleased to provide you and your colleagues with this *Resource Conservation* educational kit. Produced by the Department's Conservation Education Program, the kit is designed to help you teach the basics about the management and potential use of Illinois' renewable natural resources while keeping your students interested and eager to learn more.

Resource Conservation contains a videotape; a two-sided, full-color poster; lesson plans; and supplemental learning activities that you and your fellow teachers should find useful in supplementing your current curricula. These materials can help meet established State Goals for Learning, not only in biological and physical sciences, but also in language arts, social sciences and mathematics.

Although the kit is geared for students in grades seven through ten, you may find some portions appropriate for other grade levels. Because each school containing grades seven through ten is receiving only one copy of the kit, it's important that *Resource Conservation* isn't kept under wraps. Please share it with your colleagues. Additional copies of the entire kit are available on a short-term loan basis at your Educational Service Center and through the Illinois Library Systems.

The Conservation Education Program is the first program to offer an education package of this type to Illinois schools. *Resource Conservation* was developed in cooperation with the State Board of Education and was funded in part by the Department of Conservation and a variety of public and private organizations.

Resource Conservation is the fourth in a series of educational kits produced by the Conservation Education Program for school use. It continues the Department of Conservation's commitment to teaching Illinois' youth about the state's natural resources and making them aware of how to preserve, protect and manage these resources. Your involvement in this endeavor is instrumental in improving the ecological literacy of Illinois' young residents.

Sincerely,

Kathleen M Andrews

Kathleen M. Andrews
Education Chief
Conservation Education Program

Phil Wilson

Phil Wilson
Project Manager
Conservation Education Program

Illinois Department of Conservation 524 South Second Street Springfield, IL 62701-1787

Resource Conservation

DONATIONS AND GRANTS

Providing quality natural resource education for tomorrow's leaders is rapidly becoming a high priority for people and organizations throughout the state and nation. Production of this conservation education kit represents a cooperative effort from a variety of public and private organizations. The financial contributions and technical support provided by the following organizations have made it possible for Illinois school children to have the opportunity to learn from the Resource Conservation education kit.

DONATIONS

Illinois State Furbearer Fund
Illinois Council on Forestry Development
Illinois State Pheasant Fund
Illini Muskies Alliance
Ruffed Grouse Society
Bank One

GRANTS

U. S. Forest Service

ACKNOWLEDGEMENTS

This conservation education kit is provided by the Illinois Department of Conservation's Education Program in cooperation with the State Board of Education. The Department would like to recognize all those who gave so generously of their time and talents to make Resource Conservation a reality.

The Conservation Education Program sends a special thanks to the Illinois State Board of Education.

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Resource Conservation

CORRELATION OF THE STATE GOALS FOR LEARNING

The *Resource Conservation* education kit has been reviewed by the Illinois State Board of Education and found to meet specific State Goals for Learning in language arts, mathematics, biological and physical sciences and social sciences.

LANGUAGE ARTS

As a result of their schooling, students will be able to:

- read, comprehend, interpret, evaluate and use written material;
- listen critically and analytically;
- write standard English in a grammatical, well-organized and coherent manner for a variety of purposes;
- use spoken language effectively in formal and informal situations to communicate ideas and information and to ask and answer questions;
- understand how and why language functions and evolves.

MATHEMATICS

As a result of their schooling, students will be able to:

- understand and use ratios and percentages;
- identify, analyze and solve problems using algebraic equations, inequalities, functions and their graphs;
- understand and use methods of data collection and analysis, including tables, charts and comparisons.

BIOLOGICAL AND PHYSICAL SCIENCES

As a result of their schooling, students will have a working knowledge of:

- the concepts and basic vocabulary of biological, physical and environmental sciences and their application to life and work in contemporary technological society;
- the social and environmental implications and limitations of technological development;
- the principles of scientific research and their application in simple research projects;
- the processes, techniques, methods, equipment and available technology of science.

SOCIAL SCIENCES

As a result of their schooling, students will be able to:

- understand and analyze events, trends, personalities, and movements shaping the history of the world, the United States and Illinois;
- demonstrate a knowledge of world geography with emphasis on that of the United States;
- apply the skills and knowledge gained in the social sciences to decision making in life situations.

In addition to the aforementioned State Goals for Learning, the educational simulation game *People, Animals And The Environment* is appropriate for integration into social sciences, biological/physical sciences or language arts curricula. It has been designed to produce specific learner outcomes consistent with Illinois State Goals For Learning in each of these three curriculum fields.

Resource Conservation
Unit 1
Lesson 1

Teacher's Guide

SUGGESTED GRADE LEVELS: 7-10
SUBJECTS: Science, Social Science, Language Arts
SKILLS: comparison, presentation, research, reasoning, prediction, data collection, group process, problem solving, decision making
CORRELATION TO STATE GOALS FOR LEARNING: Science (1,2,3), Social Science (2), Language Arts (1,2,4,6)

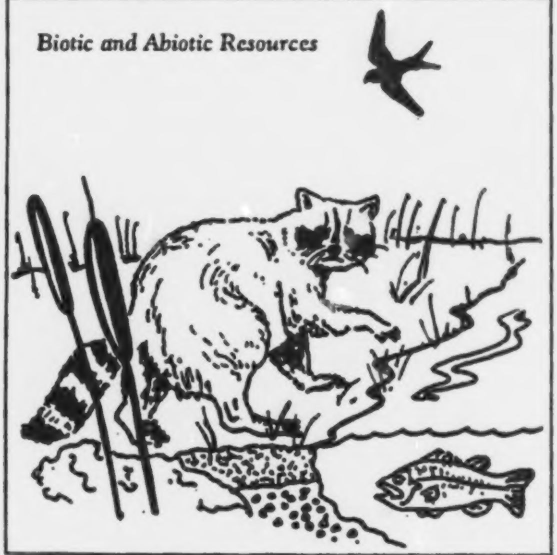
What Are Natural Resources?

Objective: Students will distinguish between renewable and nonrenewable resources and give examples of each.

Background: Natural resources are all sources of wealth or health produced by the earth's natural processes. They include soil, water bodies, the deeper layers of the earth's crust and the air surrounding earth. Natural resources also include the earth's plants and animals.

Resources can be classified as *abiotic* (non-living) or *biotic* (living). Elements, compounds, oxygen, nitrogen, water, rocks and soil are abiotic components. Biotic components are those that live and breathe, or the plants and animals.

Biotic and Abiotic Resources



Some resources are essentially limitless on a human time scale. Solar energy, wind, flowing water and tides are examples of these *perpetual resources*. A potentially *renewable resource* is normally replenished through natural processes. White-tailed deer and trees are potentially renewable resources. Sometimes these resources are used or polluted at a rate greater than the earth's ability to replenish them. If this happens, the supply of that resource may then be considered nonrenewable.

A *nonrenewable resource* is available in a fixed amount. Supplies of nonrenewable resources may be exhausted because they cannot be replaced by natural processes or at a rate to match the demand. Nonrenewable resources often become economically depleted before supplies are actually exhausted. As a rule, after 80 percent of the total estimated supply has been removed and used, it becomes too expensive to harvest the remainder. Coal, oil and fluorite are examples of nonrenewable resources in Illinois.

A *species* is a group of organisms, plants or animals that resemble each other in appearance and behavior. A species can reproduce and produce fertile offspring. Species *diversity* is the number of species present in a defined area. The species diversity on earth is estimated to be between 40 and 80 million. Of that total, only 1.5 million have been classified and named by scientists.

All plants and animals are potentially renewable resources. When a particular plant or animal population has difficulty renewing itself, it may be declared an *endangered* or *threatened* species. An endangered species is in danger of extinction. The Indiana bat and the prairie white-fringed orchid are endangered species in Illinois. A threatened species is likely to become endangered in the foreseeable future. The bobcat is an Illinois threatened species. Species are classified as threatened or endangered by two laws, the Illinois Endangered Species Protection Act of 1972 and the U.S. Endangered Species Act of 1973. A third category is not controlled by law but by decisions made by state and federal regulatory agencies. Species are placed on a *watched list* for a variety of reasons: when there is insufficient data on the population; when the population was endangered or threatened, but seems to have regained stability; or when the population is threatened or endangered in one area, but seems stable elsewhere. The bluebird is a watched species in Illinois.

Animal species can also be classified as either *game* or *nongame*. A game species is hunted for sport, food, fur or another *intrinsic value*. The white-tailed deer is a game species. A nongame species is not hunted. The cardinal is a nongame species. Some game species are protected from hunting because the species is also threatened or endangered. The prairie chicken and the river otter are game species that are protected from harvest in Illinois because of their status as endangered species.

Projects and Activities:

1. Discuss the potential for other resources to replace use of nonrenewable natural resources. How much time would be required to prepare for use of these alternatives? What examples of alternatives to nonrenewable natural resources are used currently? How many does the class use? Are they used often, occasionally or seldom?
2. Review and discuss renewable resources that could be alternative energy sources (wood, ethanol, methane).

Evaluation:

1. Identify nonrenewable resources and ask individuals to predict how long each may last at the current rate of consumption. Have students review recent publications to learn how long each is estimated to last (coal - 500 years, natural gas - 50 years, oil - 30 years). How do they explain differing estimates?
2. Identify some abiotic components of an ecosystem. Do abiotic factors differ between different ecosystems (desert, ocean, prairie, forest)? How do abiotic factors interact? What other substances do they form? How are they important to the living environment?

Extensions:

1. Research and report on different Illinois natural resources. Compare or contrast the presence and health of the resource in Illinois with other regions of the country.
2. Research and make a presentation on how humans have affected resources throughout the history of North America.

Vocabulary: abiotic, biotic, perpetual resource, renewable resource, nonrenewable resource, diversity, species, endangered species, threatened species, watched list, game, nongame, intrinsic value

Blue Jay

Prairie Chicken

CONSERVATION EDUCATION
TODAY & TOMORROW

Resource Conservation
Unit 1
Lesson 2

Teacher's Guide

SUGGESTED GRADE LEVELS: 7-10
SUBJECTS: Science, Language Arts, Social Science
SKILLS: data collection, group process, comparison, research, presentation, inference, decision making, identification
CORRELATION TO STATE GOALS FOR LEARNING:
Science (1,2,3), Language Arts (1,2,4,6), Social Science (2)

What Is An Ecosystem?

Objective: Students will identity an ecosystem, recognize components, differentiate between types of ecosystems and describe human influences on them.

Background: The place a plant or animal lives is its *habitat*. However, no single plant or animal species occupies a habitat in isolation. Habitats overlap. The various plant and animals that interact within their respective habitats make up a community. An *ecosystem* includes a community or communities with the chemical and physical factors that comprise its nonliving environment. All ecosystems must exchange energy with their surroundings. The sum of the earth's ecosystems makes up the *ecosphere*.

Many complex processes contribute to the maintenance of an ecosystem. Nutrients, the elements and compounds necessary to sustain life, are recycled through the ecosystem by a process known as the nutrient cycle. Nutrients can be organic compounds (sugars and proteins), inorganic materials (water, carbon dioxide, oxygen gas and nitrate and phosphate ions), and ions of elements (iron and copper). Many chemicals do not naturally occur in the forms required by organisms. Chemicals are constantly recycled through the living and nonliving parts of the ecosphere. These cycles include the carbon, oxygen, nitrogen, phosphorus, sulfur and water cycles that are driven directly or indirectly by energy from the sun.

A chemical may be part of an organism at one moment and part of its nonliving environment at another moment. One oxygen molecule you just inhaled may have been inhaled previously by you or your grandmother. Another molecule may have been inhaled thousands of years ago by King Tut. Yet another molecule may have passed through the lung of a dinosaur millions of years ago. Similarly, some carbon atoms in your skin may have been part of a plant, a mastodon or a limestone rock.

A *food chain* is the process nutrients take from a producer (plant) to a primary consumer (herbivore) to a secondary consumer (predator on herbivore) to a tertiary consumer (predator on predator). A simple food chain cannot accurately portray the interrelationships in an ecosystem. Another process vital to the ecosystem is the *food web*. A food web, made up of many interconnecting food chains, is a closer approximation of the natural process. As organisms interact in food webs to use and transform energy, they form an *energy pyramid*.

Each link in a food chain or level of an energy pyramid is called a *trophic level*. All organisms that fulfill the same role in the food web are part of the same trophic level. For example, all producers are on one level and all the tertiary consumers are on another level. Less total energy is available for the consumers at each succeeding level because it has been consumed and released back into the atmosphere as heat. Many species operate at several trophic levels. A bass eating an insect may be a secondary consumer. The same fish, minutes later, may eat a bluegill, thus acting as a tertiary consumer.

Carrying capacity refers to the greatest number of a particular species that an ecosystem can sustain over time. The carrying capacity of an ecosystem is not static, but may vary from year to year or season to season. During a drought or severe winter, the number of plants or animals an ecosystem can support will decrease. When food supplies are plentiful, an ecosystem may support more individuals than the previous season. The single factor in an ecosystem that limits the growth, abundance or distribution of the population of a particular organism is the *limiting factor*.

Not all ecosystems are alike. They can be small or large, simple or complex. Each habitat contains many smaller habitats, or *microhabitats*, which vary based on factors such as temperature or light. When a tree falls in a forest, it creates a new microhabitat by the increased light reaching the plants that were beneath it. As the tree begins to decay another new microhabitat develops in the moist, dark area under the trunk.

Despite their complexity, all ecosystems are important. Each provides the elements necessary to sustain its various populations. Contrary to expectations, an ecosystem's simplicity or complexity does not determine how fragile it is. The arctic tundra is one of the earth's simplest ecosystems. The tropical rain forest is one of the most complex. Both are fragile ecosystems.

Nature is not static. Ecological succession is triggered by periodic and often drastic changes such as fire, flooding, drought, glaciation, volcanos and hurricanes. Ecosystems that survive these natural disturbances evolve and become resilient.

The primary terrestrial ecosystems are deserts, grasslands and forests, each of which can be cool, temperate, or tropical. Aquatic ecosystems include oceans, estuaries, coastal wetlands and coral reefs in the saltwater group, and lakes, reservoirs, ponds, inland wetlands, streams and rivers in the freshwater group. Detailed discussions on the common ecosystems of Illinois occur in Unit 3, Lesson 2.

Humans can have profound effects on ecosystems. Often, ecosystems are simplified when converted for human use. This can occur when wetlands are filled and replaced with cornfields or when woodlands are cut down to create residential subdivisions. Simplified ecosystems such as *monoculture* crop fields or tree stands are more vulnerable to pests, diseases and weeds. Monocultures also contribute to a loss in genetic diversity and a loss of the natural landscape.

Humans aren't always a bad influence on ecosystems. Millions of people work in government agencies and private organizations and as individuals to protect the earth's valuable ecosystems. Two strategies they use are preservation and restoration. Preservation involves protecting natural ecosystems for future generations. Restoration includes any activity that returns an area to its natural state, such as reflooding wetlands or returning a cultivated field to native prairie. Mitigation is a restoration process that compensates for the loss of one ecosystem with the construction or restoration of another. For example, a developer who wants to fill a wetland for a building project may be asked to construct another wetland ecosystem.

All ecosystems—complex or simple, resilient or fragile, large or small—are important. People are a part of all ecosystems. Human actions have a great influence on natural ecosystems. Some effects are unforeseen. All influences have a positive or negative impact, depending on what is valued at that particular time. People can alter ecosystems or preserve ecosystems. Their action usually depends on the type of value they use to make their resource management decisions. Basically, if the value is people-centered, the use of the ecosystem will be consumptive. If the value is not people-centered, nonconsumptive uses of the ecosystem will predominate.

Projects and Activities:

1. Discuss different types of ecosystems in Illinois and the world. Identify the components of each.
2. Review a poster showing a habitat and discuss the components of the habitat. How are resources cycled in the habitat (water, carbon, energy cycles)?
3. Write the name of various organisms in a food chain on 3" x 5" index cards. Punch a single hole in the top and bottom of each card. Use paper clips to connect the cards in the order the organisms hold in a food web. Expand the activity with additional index cards with holes punched and paper clips to illustrate a food web.

Evaluation:

1. Illustrate the components of an ecosystem. Review the interactions that occur within an ecosystem. Discuss what happens when one component is added or removed. For example, use a lake habitat to describe the components and interactions—fish, prey, invertebrates, algae, nutrients. Decide what happens when you add or remove something from the habitat. For example, adding phosphorus through industrial effluent may result in algae blooms, oxygen depletion and a change in the fish fauna.
2. List and describe some basic biotic components of an ecosystem. How do they interact with each other? With the abiotic components?
3. What makes an arctic ecosystem simple but fragile? What makes a tropical rain forest ecosystem complex but fragile?

Extensions:

1. Research and make a presentation on the human impact on a particular resource or ecosystem. For example, the impacts associated with the construction of the railroad through Illinois, introduction of ring-necked pheasant or conversion of prairies for agricultural purposes.
2. Research a species *extirpated* from Illinois: elk, wolf, passenger pigeon, bison, black bear, mountain lion, porcupine, marten, fisher. What is the status of each species in adjacent states? In the United States?

Vocabulary: habitat, ecosystem, ecosphere, food chain, food web, energy pyramid, trophic level, carrying capacity, limiting factor, microhabitats, monoculture, extirpated

Resource Conservation
Unit 1
Lesson 3

Teacher's Guide

SUGGESTED GRADE LEVELS: 7-10
SUBJECTS: Science, Math, Language Arts
SKILLS: identification, role playing, problem solving, group process, comparison, prediction, interpretation, critical thinking
CORRELATION TO STATE GOALS FOR LEARNING:
Science (2,3), Math (6), Language Arts (1,2,4,6)

Why Manage Natural Resources?

Objective: Students will recognize the principles of population biology or population dynamics.

Background: A population includes all members of a species living in a defined area at a particular time. Many things can be learned about a species by studying an entire *population* rather than a single organism. For example, populations possess *density*, *natality*, *mortality* and an age structure, none of which can be studied in an individual organism.

Population density is the number of animals per unit of area. Natality, or the population birth rate, refers to the annual number of births per number of individuals. Mortality, or the population death rate, refers to the annual number of deaths per number of individuals. The population age structure is the distribution of individuals across various ages.

All living things have a reproductive instinct for insuring their survival. Ecologists call this a reproductive plan. Each plant and animal, no matter how big or small, can be classified as a *pioneer*, *climax* or *transition species*.

Plants and animals with a reproductive plan for a high rate of population growth are called r-planners. The r-planners make up one end of the range of living things. They mature quickly, mate often and produce large numbers of weak offspring. This, along with little or no care from the parents usually means only a few young live to reproduce and many young die. Bacteria, algae, most insects, annual plants, many fishes, some game birds, many song birds, rodents and many small mammals are all r-planners. Some fish, for example, can lay between 1,000 and 1 million eggs, but have a 99.99% mortality. Not only do bacteria inhabit live tissue, but they are the first to invade dead tissue. Annual grasses are usually the first plants to grow in freshly plowed fields. Algae reproduce in puddles, ponds and swimming pools. For these reasons, these and other plants and animals are called pioneer species.

The other end of the range is made up of plants and animals whose numbers are controlled by *competition*, predation and the amount of space in their habitat. They are called K-planners because "K" is the symbol for carrying capacity. Carrying capacity refers to the number of individuals in a given population that the habitat can support. K species have only a few large offspring that are nurtured until they reach a reproductive age. These species include wolves, bears, cougars, wapiti, bison, most medium to large mammals and some large perennial plants. Humans are K-planners that have, with the use of science, energy and knowledge, learned to speed population growth. Since they have evolved from and depend on ecosystems changed by pioneer and transition species, K-planners are also called climax species.

Because the natural world is in a constant state of change, most living things are transition species. They fall somewhere in the range between r and K planners in the number of young they bear. Their mortality rate is lower than r-planners but higher than K-planners. In other words, some connection between reproductive and mortality rates may occur, but no clear pattern exists. For example, some kinds of waterfowl have a 50% mortality in the first year, but others can live up to 20 years. White-tailed deer have a high reproductive rate but also experience a high mortality rate.

A *limiting factor* is any single factor that limits the growth of a population in a given ecosystem. Usually, factors such as *predation*, competition and disease keep a species' birth rate and death rate in balance. This maintains a stable population that the ecosystem can support. Extreme weather conditions also can be a limiting factor. In 1984, severe and prolonged cold weather and snow resulted in the deaths of many animals. With fewer animals surviving the winter, the number available to mate and reproduce the following year was considerably less.

Changes in conditions can increase or decrease an ecosystem's carrying capacity. As a population's size reaches or exceeds its capacity in the ecosystem, its death rate increases. If this correction occurs suddenly, a ***population crash*** occurs. The ***carrying capacity*** for a given habitat is not a fixed number, but may change as the quality of the habitat improves or lessens.

Ecosystems are altered by species ***immigration*** and ***emigration***. Immigrating species are those entering an ecosystem. Emigrating species leave an ecosystem. Both immigrating and emigrating species may indicate ecosystem ***degradation***.

Alien or exotic species may be introduced to an ecosystem by immigration or deliberate or inadvertent introduction by humans. Introductions may simultaneously have positive and negative effects on the ecosystem. The ring-necked pheasant is one such exotic species. A native of Asia, the pheasant has established itself as a member of Illinois' grassland ecosystems and is a popular game bird. On the down side, pheasants compete with the native prairie chicken for nesting space, parasitize their nests and harass chickens on the "booming" grounds where males call to females. The prairie chicken is an Illinois endangered species, with less than 100 individuals remaining. The starling is another example of an exotic species that competes with native species for scarce resources. Without natural predators, starlings have become successful to the point of being a nuisance.

In natural, stable ecosystems, ***prey*** species are controlled by competition between and among species and the number of predators. Manipulation of many of Illinois' natural ecosystems has disturbed this balance. Consequently, fish and wildlife management is necessary to control population levels.

Projects and Activities:

1. Review and research the table of exotic species. Identify the positive and negative influences of each species in Illinois. What guidelines would you recommend be used before the introduction of an exotic species?
2. Students will be able to discuss factors influencing animal populations, such as weather, predation and competition.

Evaluation:

1. Identify predators and prey species in several ecosystems. How have humans affected these relationships? Examples for study include the wolf and deer, passenger pigeon and peregrine falcon, rabbit and coyote, robin and feral (wild) cat, bag worm and cuckoo, grey fox and squirrel, muskrat and mink, red fox and pheasant, and bass and bluegill.
2. Review the "Hunting and Trapping" scenario in the *Natural Resources Role Playing* activity and assume the role of a wildlife manager charged with addressing the wildlife issues.

Vocabulary: population, density, natality, mortality, pioneer species, climax species, transition species, competition, limiting factor, predation, population crash, carrying capacity, immigration, emigration, degradation, prey

EXOTIC SPECIES ADVANTAGES AND DISADVANTAGES

SPECIES	ADVANTAGES	DISADVANTAGES
ring-necked pheasant	popular game bird	nest parasite
scotch pine	Christmas tree	disease and dispersal
coho salmon	human food source	competes with native species
carp	human food source	competes with native species
rusty crawfish	bait	displaces native crawfish, disturbs walleye spawn
starling	seed dispersal	displaces native species, altering natural habitat
gypsy moth	bird food source	forest defoliation
house sparrow	seed dispersal	displaces bluebirds and cliff swallows
gray partridge	popular game bird	competes with native species for food and habitat
zebra mussel	food source for diving ducks	kills native mussels, encrusts bottom of boat, infests water pipes and motors
garlic mustard	ground cover	invades and converts native forests into weed patches
japanese honeysuckle	ornamental vine	dominates forest understory growth
winter creeper	ground cover	dominates forest understory growth
purple loosestrife	food source for shore and wading birds	dominates wetland plant communities

Resource Conservation
Unit 1
Lesson 4

Teacher's Guide

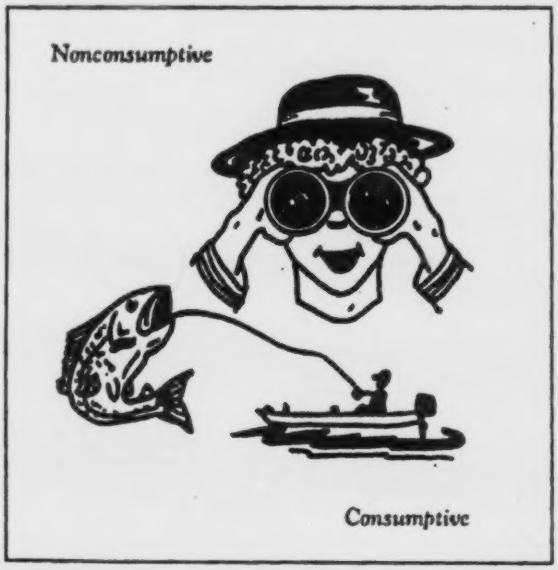
SUGGESTED GRADE LEVELS: 7-10
SUBJECTS: Science, Social Science, Language Arts, Math
SKILLS: comparison, research, group process, data collection, presentation, critical thinking, graphing, interpretation, classification
CORRELATION TO STATE GOALS FOR LEARNING: Science (1,2,3,4), Social Science (2), Language Arts (1,2,4), Math (6)

Who Are the Users?

Objective: Students will recognize and compare consumptive and nonconsumptive use of natural resources and cite examples of each.

Background: Humans are the most diverse users of natural resources. Natural resources provide food, water and shelter necessary for survival. Natural resources provide a variety of other products such as energy and recreation.

The use of resources can be *consumptive* or *nonconsumptive*. Consumptive use of a resource uses it up or degrades it to the point it can no longer be used for the same purpose. Renewable resources can be consumed. Hunting a deer and using it for food is a consumptive use. Nonrenewable resources can be consumed. Burning natural gas to heat your home is a consumptive use. Causing severe and irreversible water pollution is a consumptive use.



Nonconsumptive use leaves the resource intact, such as birding, sketching, photography and hiking. Education, research and recreation are common nonconsumptive uses. Using light from the sun to illuminate your house or taking a photograph of a bird are nonconsumptive uses. Catching a fish and returning it to the water or using water for canoeing are nonconsumptive uses.

Sometimes use of a resource is clearly consumptive or nonconsumptive. In other instances, a seemingly nonconsumptive use may indirectly impact the resource. A wetland may provide critical nesting habitat for an endangered bird, but increased human use may cause the bird to abandon its nest or young.

Despite their use, resources must be used responsibly. Even seemingly harmless uses may damage the resource. For example, a hiking and biking trail may lead to soil compaction, causing root damage to trees or erosion and loss of soil. Attracting visitors to a wetland area to view and photograph a rare plant has educational value but may result in the degradation of the habitat.

Many resources are managed to allow multiple use. A forest system can be managed to allow harvest of the timber. The same management plan also can provide vegetative cover to reduce erosion and provide wildlife habitat. The forest also has aesthetic values and provides recreational opportunities. A lake can be managed to provide recreational opportunities, water for irrigation and wildlife habitat. A hydroelectric plant creates energy from a river system and provides boating and fishing opportunities and drinking water for downstream communities.

For Native Americans, the Illinois River and its watershed were one of the world's best places to live. From the rich prairie soils grew tall, healthy maize. Hardwood forests seemed limitless. With the settler came a different way of life, a way of taking more from the land than was needed to survive. Plentiful supplies of resources and an open market resulted in overharvest. The environment could only bear a certain level of harvest. With continued overharvest, early commercial fishermen and market hunters worked themselves out of jobs. Given time and protection, populations of most resources have stabilized.

The forest industry remains an important part of Illinois' economy. In 1986, commercial harvest of Illinois' hardwood forests provided landowners about $7 million in income. Over 150 species of trees found in Illinois can be harvested for the value of the timber. The wood products industry produces products for sale and employs many people. Furniture, decorative trim, flooring and veneer are made from oak. Tool handles and handmade bows are made of hickory. Maple makes good flooring and cottonwood is used for fine stationery. Walnut is used to produce fine furniture.

During the 19th and early 20th centuries commercial fishing was economically important in Illinois. By 1908, fish harvest on the Illinois River had grown to 23 million pounds. This generated $700,000 for the local economy and created many jobs. Similarly, 2,600 "clammers" harvested mussels in the Illinois during the same era. Overharvest of fish and mussels resulted in a decline in the industry in the 1930s. Today, commercial fishing no longer is an economically important industry. The zebra mussel, an exotic species, is affecting populations and harvest of native mussels.

Turn-of-the-century market hunting also suffered the effects of overharvest. By 1914, after decades of relentless "Arkansas shooting" or shooting into rafts of ducks and geese as they rested during migration, some species began to disappear. This led to a ban on hunting wood ducks in 1914 and a ban on market hunting in 1918. Since then, the wood duck and the giant Canada goose have made remarkable comebacks. Most other migratory waterfowl populations have declined. The ban on market hunting has not offset the loss of habitat.

Many people find enjoyment in outdoor activities. Seventy percent of the adult population of Illinois participates in pleasure walking. Forty percent of the population bicycle, 27 percent fish, 7 percent hunt and 1 percent trap. All outdoor activities depend on healthy natural resources.

All people have a stake in conserving our renewable natural resources. In some instances multiple use of a given resource can create resource degradation and spatial conflicts among users. Other units in this education kit explore ways we try to minimize degradation and conflict through education and resource management.

Projects and Activities:

1. Identify a natural resource that has both consumptive and nonconsumptive uses. Research the positions of people that support each position. Conduct a class debate on the different views.
2. Chart the amount of natural resources used by individuals and the class as a whole for a specific length of time. Discuss individual differences for use (for instance, the rural resident who has access to and burns wood for heat versus an urban resident who uses gas heat).
3. Develop a list of natural resources users and the types of resources each uses. Organize the information and put it on a bulletin board. Using push pins and string, develop a web of compatibility or incompatibility among user groups. Discuss how to maximize multiple use of various groups.

Evaluation:

1. Discuss how many natural resource users can be listed from the poster contained in the education kit. Conduct a classroom survey on what natural resource uses the students have been involved in. How many students are familiar with the natural resource land base and its associated uses?
2. Have each student select one renewable natural resource for study. Ask them to develop a list of potential users of the resource and how each uses it. Identify the consumptive and nonconsumptive uses of each. For example: OAK TREE - bird=nest (nonconsumptive), food (consumptive); human=shade, beauty (nonconsumptive), wood products (consumptive); deer= shade (nonconsumptive), food (consumptive).
3. Have students individually develop a list of the ways a particular habitat (forest, wetland, grassland) can be used. Classify each use as consumptive or nonconsumptive. After individual lists are prepared, conduct a class discussion and compile a master list of uses.
4. Identify a resource that is renewable and consumptive, one that is nonrenewable and consumptive, one that is renewable and nonconsumptive, one that is nonrenewable and consumptive.

Extensions:

1. Conduct a photographic historical archival search of resource changes in Illinois or your county.
2. Research the impact Native Americans, pioneers and current residents have had on the land. Discuss the differences in philosophies.

Vocabulary: consumptive use, nonconsumptive use, commercial (use)

Resource Conservation
Unit 2
Lesson 1

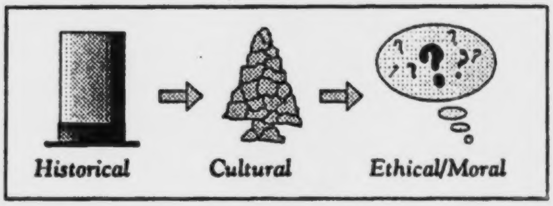
Teacher's Guide

SUGGESTED GRADE LEVELS: 7-10
SUBJECTS: Social Science, Language Arts, Science
SKILLS: inference, decision making, observation, prediction, evaluation, presentation, writing, group process
CORRELATION TO STATE GOALS FOR LEARNING:
Social Science (2,5), Language Arts (1,2,3,4,6), Science (1,2,3)

Values and Principles

Objective: Students will consider values and principles relating to natural resources.

Background: A wide range of opinion exists regarding management of our natural resources. What one person views as an essential natural resource use or related recreational opportunity, others may rate as a luxury or may simply be indifferent. Natural resource issues tend to be complex and have many ecological, political, social, legal and economic implications.



People interested in an issue bring a variety of emotions, biases, beliefs and needs to discussions. The views of an individual are influenced by their lifestyles; traditions; religions; and personal, political and moral beliefs. Local and regional differences in values may exist. For example, the value placed on a pond may be higher in a dry environment than in an area along a river. Because of these varying perspectives, reaching decisions on natural resource issues is seldom easy. A lengthy review process and opportunities for public input may be required.

Aldo Leopold (1886 - 1948) helped establish the idea of basing scientific decisions on principles. He is commonly known as the father of modern conservation for his efforts to establish an ethical basis for his scientific endeavors. The most famous of his principles is called Leopold's land use ethic. This states that an ecological *management* decision is ethical if it generally maintains the earth's life-support systems for humans and other species, and wrong when it interferes with these systems. In his book A *Sand County Almanac* (1949), Leopold wrote:

> *All ethics so far evolved rest upon a single premise: that the individual is a member of a community of interdependent parts . . . The land ethic simply enlarges the boundary of the community to include soils, waters, plants and animals, or collectively: the land . . . A land ethic of course cannot prevent the alteration, management and use of these "resources," but it does affirm their right to continued existence, and, at least in spots, their continued existence in a natural state. In short, a land ethic changes the role of Homo sapiens from conqueror of the land-community to plain member and citizen of it. It implies respect for his fellow-member, and also respect for the community as such.*

An environmental value is the comparative worth placed on something in the environment. These values determine how we act toward the environment and influence how personal and societal decisions are made. Several types of values exist:

political -	the role or position of a governmental agency
economic -	use for food, clothing, shelter and other benefits
religious -	faith
ecological -	role in maintaining a natural ecosystem
scientific -	providing an understanding of biological functions
cultural -	societal customs and beliefs
educational -	providing an understanding of a species and the role people play in the environment
aesthetic -	as a source of beauty and inspiration
social -	shared human emotions and status
recreational -	providing leisure activities
egocentric -	focus on human benefit of resource
health -	positive human conditions
ethical/moral -	responsibilities and standards
historical -	connection to the past

Although these values are listed separately, they may be interwoven and are not always easily recognized as distinct units. For instance, creation of a new park may come about because of political values although the demand originated from the historical significance or educational value of the area.

Three major views exist on the value of natural resources. ***Anthropocentric*** views value the resource from a personal need and interest. A ***biocentric*** viewpoint considers that all plants and animals are worthy of consideration. Those who value the balanced system of living and non-living things have a ***philosophical*** viewpoint. Using the example of an untouched tract of prairie, the anthropocentric viewpoint would value the potential of the area for agricultural production. The biocentric viewpoint would recognize the value of the plants and animals inhabiting the area. Finally, the philosophical viewpoint would recognize the value of the prairie as an ecosystem supporting life on Earth.

Projects and Activities:

1. Review the quotes listed in the "A Closer Look" section. Based on those readings, do you think the authors have an anthropocentric, biocentric or philosophical viewpoint? Why? Do you agree? Discuss how some of these people would react to current issues such as timber harvest and the spotted owl, the greenhouse effect or solid waste disposal.
2. Review periodicals, news releases, newspapers and other resources to identify natural resource issues and the principles and values presented in the material. Select one issue and track the coverage and progress made over an extended period of time. How much coverage does it receive? Do you think the coverage is fair or biased? How is a solution reached? Who is affected by the decision?
3. Have each student develop a personal environmental creed of ethics starting with the phrase "I believe that . . . ".

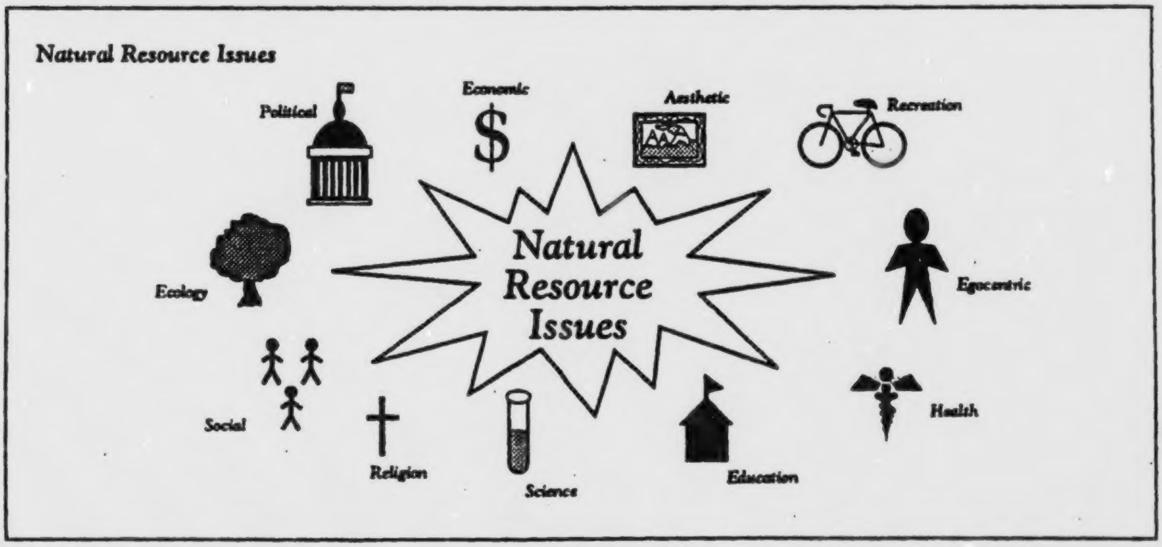
Evaluation:

1. Conduct a mock point-counterpoint debate on current natural resource issues or the various values of a natural resource. Through these debates students should realize that all are resources and values are equally important.
2. Using the examples in the text of anthropocentric, biocentric and philosophical views, what position do you feel most settlers had? Native Americans? Scientists? Which viewpoint do the students take on current natural resource issues? Do they take different stands on different issues? Why?
3. Provide students the list of the fourteen value types. Ask them to select a natural resource and write one sentence about the resource for each value.

Extensions:

1. Invite a person responsible for managing a habitat area to visit your class. Follow the visit with a field trip to the site. Discuss opinions on support or opposition to management practices used.
2. Walk through an area and develop a list of the natural resources present. What monetary value would you assign to each resource? What would be the total economic value of the natural resources of the area? How would you collect money or fine a person for damaging the resource?
3. What values does society place on various natural resources and experiences such as a clear stream, preserved habitat, appealing scenery, etc.

Vocabulary: management, anthropocentric, biocentric, philosophical


Natural Resource Issues

Resource Conservation
Unit 2
Lesson 2

Teacher's Guide

SUGGESTED GRADE LEVELS: 7-10
SUBJECTS: Science, Language Arts, Social Science, Math
SKILLS: decision making, analysis, evaluation, critical thinking, comparison, research, data collection
CORRELATION TO STATE GOALS FOR LEARNING:
Science (2), Language Arts (1,2,3,4,6), Social Science (5), Math (2)

Conflicts, Resolutions and Planning

Objective: Students will apply knowledge of conflicts, resolutions and planning by attending public meetings or hearings and reporting their findings back to the class.

Background: Webster's New World Dictionary (1980) defines a conflict as a "sharp disagreement or opposition, as of interests, ideas, etc." Conflicts commonly arise when a difference of opinion exists between "needs" and "wants." A need is anything that is necessary for survival. Food, cover, space and water are needs of living things. A want is anything above and beyond a need. A nicer home, car, closet full of clothes and CD player are wants. Needs and wants vary between societies and levels of wealth. Our perception of needs and wants may be affected by exposure to advertising.

Controversy is not bad. A conflict may not seem to have a "correct" answer. Through conflict people are provided opportunities to learn about issues and make a decision on their personal view. If so motivated, they then will take action to get the result they support.

A variety of conflict types exist. Conflicts exist when people have different opinions on the perceived best use of a resource. For example, conflicts would exist in deciding whether a trail would be best used for bicycling or horseback riding. The issue of allowing hunting and trapping or banning these activities is a conflict of perceived use.

Changes—new technologies, increases in populations, decreased availability of a resource—result in conflicts. Conflicts may occur over use of a particular ecosystem or habitat. For instance, industrial uses of a water supply may compete with private water users. Also, water use for navigational purposes may result in conflicts with recreational user groups such as anglers, boaters or waterfowl hunters.

Resolving conflicts may be a simple or complex process. Many types of resolutions exist. Key to successful resolutions are effective communication and the ability to educate interested persons of the various positions. Involved parties may meet to negotiate or *compromise* differences. Public policy decision makers may be called upon to help with negotiations or introduce legislation to clarify disputed issues. The public may be called upon to provide additional input at a *public meeting* (a meeting for the public to express their views about a particular project) or *public hearing* (similar to a public meeting but with a hearing officer present). Ultimately, the public may resolve issues by exercising their right to vote.

A cost-benefit may help resolve conflicts. This analysis will compare the short-term and long-term costs of the proposal to the benefits. If costs exceed benefits, the decision usually is to abandon the project or service. If benefits exceed costs, the project or service is continued.

Another way to resolve conflicts is to develop a *plan*. A plan provides a way to organize your thoughts and present them in a way that will clearly convey the intent of the project. Because people have differing views, plans minimize conflicts and address controversial issues openly at the onset of a project. Plans outline options, identify roles of participants and examine the long-term effects or benefits on the resource.

Plans include many sections. The goal statement clearly identifies the intended purpose of the action. One or more objectives further define the goal statement. Finally, strategies identify the process to be undertaken to complete the intended goal. Effective plans consider a variety of factors, including the needs of affected parties and appropriate policies, laws and regulations.

Approval of a plan can be made in three manners. If a group of people review a plan and agree on the strategies to be taken, they have reached *consensus*. If the plan is developed by or presented to legislators, the action taken will be a vote. *Legislative* approval allows most participants to be represented in the final action. If approval and implementation of a plan are the responsibilities of a single person, he/she has the *authority* to make decisions without consulting others.

Projects and Activities:

1. Research the various types of groups that are involved in planning and management of resources (local, state and federal agencies, constituent groups). What are the responsibilities of each? Which have jurisdiction over resources? Which resources? How is citizen input solicited and used by each? How does each enforce violations to the resources they are responsible for?

2. Attend a public meeting or public hearing on a resource issue. Have the students research the topic and interview community citizens to find out their stands on the issue. A class spokesperson should then present the findings at the meeting or hearing.

Evaluation:

1. Identify a project in your community that has potential environmental impacts. Work in teams to complete the sample EA in Unit 4. Research the topic, draft an EA statement and make a recommendation of "No Significant Impact" or "Significant Impact." Have each group make an oral presentation to the class on their findings. Have a panel serve as the regulatory authority to review the EA presentations. Do they agree with the recommendations?

2. Conduct a mock public meeting regarding a current land-use issue occurring in your area. Then, have students attend the public meeting to compare the nature and effectiveness of their arguments with those presented during the meeting.

Extensions:

1. Select a current environmental issue and invite involved parties from various sides to speak before the class. Develop a list of questions before the first speaker and use this standard list for each speaker. Compare their answers. Were their answers based on scientific knowledge, emotion or a combination?

2. Conduct an in-depth research project on the NEPA process.

Vocabulary: public meeting, public hearing, compromise, plan, consensus, legislative, authority

A SAMPLE RESOLUTION PROCESS
National Environmental Policy Act (NEPA)

The National Environmental Policy Act (NEPA) of 1969 defines the environmental policy of the nation and directs all federal agencies to utilize an interdisciplinary approach to insure the integration of sciences and environmental design. NEPA also identifies and develops methods for insuring that environmental values are given appropriate consideration and requires an Environmental Impact Statement (EIS) or an Environmental Assessment (EA) for all actions that may significantly alter the environment.

An EIS must include an assessment of the impact, unavoidable adverse effects, and alternatives to the proposed action; relationships between short-term uses and long-term productivity; and any irreversible or irretrievable commitments to resources that may be involved as a result of the action. Consequently, an EIS is considered difficult and costly by public and private sector developers. The EA, on the other hand, is an easier, less expensive process. Often, it is a short, concise description of the project and its potential environmental side effects. If the EA is erroneous or inconclusive, however, the agency in charge of issuing the permit may request an EIS.

NEPA includes a public input process involving testimony, a hearing officer, and a formalized agenda. Input must be topic-specific and commenters are limited on the amount of time they have.

Teacher's Guide

SUGGESTED GRADE LEVELS: 7-10
SUBJECTS: Science, Language Arts, Social Science, Math
SKILLS: research, group process, data collection, interpretation, lobbying, comparison, observation, problem solving
CORRELATION TO STATE GOALS FOR LEARNING:
Science (2), Language Arts (1,2,3,4,6), Social Science (2), Math (2)

Legislation and Enforcement

Objective: Students will recognize the processes and people responsible for balancing use of natural resources.

Background: Management of natural resources is a responsibility shared by local, state and federal agencies with natural resource and enforcement authorities. Ownership of the wildlife in the United States is held in trust by the government for the people. At the state level, each state has enacted legislation mandating that a conservation or natural resource agency be established. Each agency has implemented laws and regulations to ensure the welfare of wildlife. Enforcement activities are designed to protect the resource, deter further *degradation* and provide equal treatment to all persons that use or enjoy a resource.

There are two types of laws. Some laws rely on voluntary *compliance* by the participant. These moral-based and self-limiting laws include values and ethics. Other laws are more formal and are written, published and enforced by law enforcement agencies.

The degree of protection provided any species varies widely, from total protection to no protection for those species legally harvested throughout the year. An inventory of population numbers is used by biologists to find if a species has reached a critically low level that threatens continued survival of the population. This finding would result in a recommendation that the species be listed as endangered or threatened. By Illinois statute it is "unlawful for any person to possess, take, transport, sell, offer for sale, give or otherwise dispose of any animal or the product thereof of any animal species on the Illinois list . . . or to deliver, receive, carry, transport or ship in interstate for foreign commerce plants listed on the federal list . . . or take plants on the Illinois list . . . ." The Illinois Endangered Species Protection Board, in consultation with the Illinois Department of Conservation, is responsible for listing, delisting or changing the status of species on the Illinois list.

The same type of biological inventory may reveal that a surplus of animals exists and that the population may be hunted or trapped without jeopardizing it. Recommendations to legislate a fishing, hunting or trapping season provide a range of protection. Limits may be set on the dates harvest is allowed or the number that can be possessed in a day or season. A decision may be made to close hunting and trapping season while young are born and reared. Laws also provide protection on the manner in which a species is taken. For instance, it is illegal to take aquatic life using electricity, lime, acid, dynamite, snares, firearms or wire nets.

Because many species of wildlife are migratory and cross artificial borders created between states and counties, federal regulations also affect wildlife. Laws enforced by the U.S. Fish and Wildlife Service protect endangered and threatened species, songbirds, birds of prey and waterfowl. The National Environmental Policy Act (NEPA) passed in 1969 requires a comprehensive evaluation of the environmental effects of an activity before it is begun. All federal agencies must respond to the policy and address the effects, potential alternative actions and the environmental consequences.

In 1972 Congress enacted Section 404 of the Clean Water Act that regulates the discharge of dredged and fill materials into water. The U.S. Environmental Protection Agency and U.S. Army Corps of Engineers jointly administer the Act. Advice is provided by the U.S. Fish and Wildlife Service, National Marine Fisheries Service and state natural resource agencies. The Act requires that fill material (dirt, rocks, etc.) can not be put into rivers, lakes or streams if there is a practical alternative that is less damaging to the resource. If minimal impact is expected, the Corps of Engineers can issue a "general permit." Otherwise, a permit must be reviewed through the "individual permit" process.

This process entails a public notice, comment permit, public hearing, evaluation by the Corps leading to an environmental assessment and a statement of finding. The assessment and finding may recommend the permit be issued or denied.

The Environmental Timeline (stand-alone activity) contains brief information on a variety of national policies.

Cities are sometimes given the authority to manage natural resources when no statewide interest exists for that resource. This is called home rule. Organizations such as local park districts that control the consumptive or nonconsumptive use of resources within a recognized community have home rule authority.

Individuals or organizations that recognize a need for legislative changes may seek introduction of legislation. Legislation may originate in either the House or the Senate. The process involves a series of readings, committee reviews, hearings, amendments and votes. After favorable action in one chamber, the bill is sent to the other chamber and goes through a similar process. Bills that pass both chambers are sent to the governor for signature. Throughout the process, legislator and ***constituent*** group support is crucial for passage or repeal of legislation.

Effective enforcement depends on the ability of the public to understand and accept the regulations. Laws that carry a punishment such as a stiff fine or jail term are more effective than ones that result only in a verbal reprimand or minor fine. Enforcement is also most effective when the responsible agency has the manpower and financial resources to train officers, maintain routine patrols, analyze samples, and collect and present evidence.

Enforcement of laws and regulations affecting natural resources are some of the responsibilities of Conservation Police Officers. People holding these positions must have knowledge and experience with outdoor skills and a comprehensive knowledge of fish, wildlife and boating laws. In addition, these people must have the skills to work with the public to enforce the law and educate them of changes in laws and regulations.

Estimates show that ***poachers*** take as much fish and game as legitimate sportsmen do during the legal seasons. Poachers often do not confine their killing to game species, but may kill endangered or threatened species and non-game. Poachers also take plants, such as spectacular flowering plants for their gardens or harvest a species such as ginseng for sale to foreign markets. Many states have a citizen monitoring program to encourage concerned citizens to report observed violations. Illinois' "Target Illinois Poachers" program offers a toll-free telephone number (1-800-252-0163) to report resource violations. All sources of information are kept strictly confidential.

The promotion of ethical outdoor behavior is a common feature in articles in magazines and television programs. A variety of constituency groups such as Ducks Unlimited, Pheasants Forever, Ruffed Grouse Society, Muskie Alliance and local hunting and fishing clubs also promote ethical behavior and self-monitoring through meetings, events and publications sponsored by their organizations.

Projects and Activities

1. Interview state public officials to find out their stands on natural resource issues and any related proposed legislation. Ask them what environmental legacy they would like to be known for when they leave office. Practice appropriate interviewing techniques before the interview. Use "why" and "how" questions to gain insight on their position(s).
2. Locate the names and addresses of federal legislators. Learn the proper procedure for corresponding with dignitaries. Prepare a letter stating your stand on a specific natural resource issue. Share responses received with the class.
3. Research the types and frequency of violation of ethics and laws.

Evaluation:

1. Research a proposed natural resource bill and identify the benefits and drawbacks of the proposal. Identify what groups support and oppose the legislation. Establish teams to represent each side and debate the merits or shortcomings of the legislation.
2. Interview a variety of local, state and national groups to learn about their positions on the use of resources. What mechanisms do they use to promote their positions?
3. Have students select an environmental law that they think needs changed to improve some health, safety or ***aesthetic*** environmental aspect. Explain their reasons and outline a proposed plan to effect the necessary changes (period, people involved, process, key opponents and proponents, etc.).

Extensions:

1. Research other federal laws to decide the level and type of natural resource protection provided by each: Migratory Bird Treaty Act, RCRA, Endangered Species Act, Pittman-Robertson and Dingell-Johnson Acts.
2. Research how legislation is prepared, introduced and enacted. Follow a natural resource bill through the legislature.

Vocabulary: degradation, compliance, constituent, poachers, aesthetic

22

Resource Conservation
Unit 3
Lesson 1

Teacher's Guide

SUGGESTED GRADE LEVELS: 7-10
SUBJECTS: Language Arts, Science, Math
SKILLS: identification, evaluation, analysis, inference, interpretation, role playing, research, writing, data collection, comparison, graphing, research
CORRELATION TO STATE GOALS FOR LEARNING:
Language Arts (1,2,3,4,6), Science (1,2), Math (4,6)

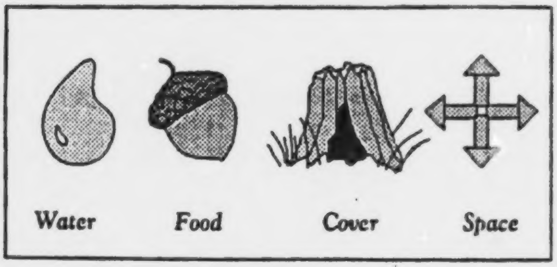
Species Management

Objective: Students will recognize the diversity of plant and animal species that occur in Illinois and distinquish between non-game, endangered and threatened species, game species and woodland plant species.

Background: Approximately 200 species of nesting birds, 57 species of mammals, more than 200 species of fish, 94 species of amphibians and reptiles, hundreds of invertebrates and more than 3,000 species of vascular plants can be found in Illinois. Techniques to manage these species vary depending on the numbers of individuals in the populations and desirability of the species for food or other economic benefit to humans.

Maintaining a diversity of plant and animal species is important to a healthy environment. Plants and animals have aesthetic, recreational, tourism, ecological and economic values. Ninety percent of the significant food plants today were domesticated from wild tropical plants. Medicines derived from plants are used by about 76 percent of the world's population. About half of the prescription and non-prescription drugs are derived from wild organisms.

All living species have four basic requirements for life—water, food, cover and space. Water requirements vary by species. Plants absorb water through their roots and leaves. Animals obtain water directly by drinking or indirectly from foods they consume. Foods may be available in different quantities at different times of the year. Foods consumed by animals may be classifed as preferred (used as long as available), staple (used to maintain body weight), emergency (can not sustain body weight for long period) or stuffing (no nutritional value, only provides bulk).



The type of cover required by a species at any time can differ. Wildlife need cover to conceal themselves while traveling and to escape from predators and climatic conditions. Cover requirements may be seasonal, such as the cover needed during the reproductive season, for hibernation or while molting. Cover is also needed while resting, loafing, sleeping or roosting. The space required by each species is also highly variable and will reflect their needs for water, food and cover.

When determining how to manage a species, biologists strive to maintain healthy habitats and animal populations while providing opportunities for recreational and commercial uses of the resource. Consideration must be given to the food, water, cover and space requirements of each species. The species assessment includes an evaluation of the effects a management practice will have on other natural resources. Consideration for land uses and the economic feasibility of the practice are also included.

Some species management practices can be directly attributed to a habitat management practice. The goal of habitat management is to enhance or improve the habitat. Even if an area is managed for a particular species, many other species benefit. Other species management practices such as bag limits or length limits (fish) are designed to spread the harvest among people to prevent overharvest. Habitat management practices are discussed in detail in Unit 3 Lesson 2. Some practices improve habitat and increase the amount of food and cover available. Propagation, direct seeding, regeneration, rejuvenation, transplanting and reduction of competition are habitat management practices.

Species management is a multi-staged process. The first stage requires conducting an inventory to determine the number, abundance, health and distribution of a species or habitat. An inventory of a fixed population such as trees or herbaceous vegetation can be easy. An inventory of live, moving species such as Canada geese is more difficult. A large-scale inventory such as a statewide inventory of Canada geese or white oaks can be difficult, labor intensive and costly.

In some instances, a *census*, or count of the number of given species in a given area, is taken. A count of the total population is an absolute census. A relative census shows increases or decreases in the population. In other instances, an *estimate* of the population is made. Estimates are scientific "guesses" of the number present in a population based on a census of a small portion of the population. Comparing results of a census or an estimate from previous sampling periods or other habitat areas will provide trends to show if the population is increasing, static or decreasing. Common sampling techniques used by fisheries managers are ***electroshock, seining*** or ***gill netting*** a body of water. Spring bird counts, dove "coo" counts, or prairie chicken "booming" counts are some techniques used to sample birds. Mammal populations may be determined through track counts or aerial inventories of large game (deer).

Studies of individuals may be made to evaluate the health of the population. Hunting, fishing or trapping seasons provide opportunties to examine individuals. Individuals harvested may be examined for the presence of diseases or parasites. The amount of body fat of individuals may indicate their resistance to diseases and parasites and ability to survive harsh weather conditions.

After collecting detailed information on the population, its health and the quality of the habitat, the biologist develops a management plan. In some instances information may be unavailable or unreliable. The training and experience of the biologist becomes crucial. Management plans include information on site topography and the plant and animal species present. Information is needed on the food, cover, space and water the species require to survive. In addition, knowledge of the anticipated resource users (hunters, anglers, birders) must be considered and plans made to accommodate or schedule potentially conflicting uses.

Following any management practice, additional inventories must be conducted to determine if the practice has resulted in the desired objective.

Non-game and Endangered and Threatened Species

The term "non-game" refers to those animals that have not traditionally been harvested by humans for food and clothing. Non-game animals range from hawks, owls and songbirds to bats, deer mice, snakes, toads, most turtles and frogs and many species of fish.

A threatened species is any species likely to become endangered in the foreseeable future. Illinois listed 39 animal species as threatened in 1994. An endangered species is one that is in danger of extinction. In 1994, Illinois listed 109 animal species as endangered. In 1994, Illinois listed 306 endangered and 57 threatened plant species (figure 1).

Figure 1

PARTIAL LISTING OF ILLINOIS THREATENED AND ENDANGERED SPECIES

THREATENED ANIMALS: banded killifish, bantam sunfish, Illinois chorus frog, coachwhip snake, green water snake, common moorhen, brown creeper, pied-billed grebe, loggerhead shrike, bobcat, golden mouse, rice rat, cobweb skipper (butterfly).

ENDANGERED ANIMALS: bigeye chub, bluehead shiner, cypress minnow, harlequin darter, lake sturgeon, silvery salamander, Illinois mud turtle, broad-banded water snake, American bittern, snowy egret, peregrine falcon, black rail, long-eared owl, gray bat, Indiana bat, river otter, sheepnose (mussel), fat pocketbook (mussel) and arogos skipper (butterfly).

THREATENED PLANTS: narrow-leaved green milkweed, blazing star, ground juniper, leatherleaf, green trillium and narrow-leaved sundew.

ENDANGERED PLANTS: water willow, bloodleaf, water arum, speckled alder, thismia, prairie spiderwort, round-leaved sundew, bearberry, sweetfern and Kankakee mallow.

Species become endangered or threatened for a variety of reasons. Some populations decline as a result of a chemical or other pollutant introduced into their habitat.

Often, the simultaneous clearing of critical habitat and introduction of an exotic species may alter habitats significantly and cause a population level to decline. Historically, indiscriminate and unregulated harvest by hunting, fishing and trapping caused decline of some species such as the passenger pigeon. Regulations have been enacted to address the problems of over harvest of game species. Today, however, some species such as butterflies and plants are indiscriminately collected.

Endangered and threatened species often have small populations, specific habitat requirements and limited ranges. While a population may be low in Illinois, warranting protection, habitat conditions in adjacent states may be adequate to ensure a healthy population. For example, the Eastern wood rat is an endangered species in Illinois. It is found only in a few locations in southern Illinois, but that is the northernmost extent of its range.

Extinction is a natural process. With increases in human populations and demands for natural resources, the extinction process has shifted from one that is gradual allowing for replacement of species to one that is rapid without filling empty ***niches.***

Genetic factors can often play a role in the management of endangered species. While reintroduction is one approach to helping endangered species, managers must first consider the genetics of the species to determine how closely related the reintroduced animals or plants are to the ones that still occur there. In most cases, it's for them to be as genetically similar as possible. However, in some instances a population of endangered species has been so isolated for so long that it is considered "inbred." It then may be necessary to introduce individuals from another location to get greater genetic diversity. In Illinois, this was recently done to help the greater prairie chicken. Birds from another state were brought to Illinois to boost our small population of this endangered bird.

The primary objectives in managing non-game and endangered and threatened species are to maintain the biological diversity of a habitat, protect the population from further harm, increase numbers and attract species desirable for viewing, and prevent extinction or extirpation of the species. Management practices may include a ***prescribed fire***, a large-scale timber cutting, removal of exotic species, reflooding an historic wetland, restricting human use of an area or taking no action.

Game Species - Fish and Wildlife

The term "game" refers to those animals that have been traditionally harvested by humans for food and clothing. Birds, mammals, fish, turtles and frogs may be classified as game species (figure 2).

Figure 2

COMMON EXAMPLES OF ILLINOIS GAME SPECIES

BIRDS: ring-necked pheasant, bobwhite quail, wood duck, mallard, Canada goose, wild turkey.
MAMMALS: white-tailed deer, fox and gray squirrel, raccoon, red and gray fox, coyote, beaver, muskrat.
FISH: bluegill, bass, catfish, pike, perch.
TURTLES: snapping turtle.
FROGS: bullfrog.

Like all natural sciences, wildlife and fisheries management methods are based on principles and theories that follow repeated observation and experimentation. A theory is an idea about something you have observed. If you see your dog come out of the marsh with a dead muskrat in his mouth, you may assume he killed it. Not until you actually see him kill the muskrat can you be sure. This is the difference between a theory and a fact. A theory can only be proven by experience or experimentation.

Wildlife and fisheries biologists must rely not only on theories they have proven through experimentation, but also on observation. For example, biologists are often asked by landowners to manage a field or pond for a specific type of animal population. Theories that work in one habitat may not work in another. Every system is different.

Two basic wildlife management theories include habitat management to provide an opportunity for a population to increase and population management to harvest the surplus.

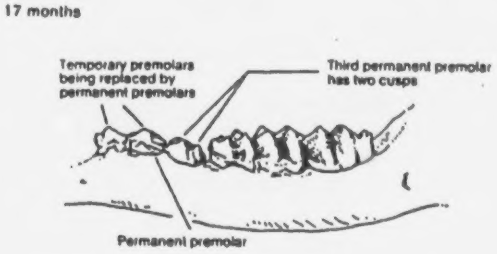
"Setting back" the succession of the land by burning, mowing or plowing is one commonly used method of habitat management. This method not only reduces competition between native prairie plants like little bluestem and exotics like fescue, but also fertilizes the soil. With a better chance to grow, native prairie plants should provide food and cover for native wildlife like rabbits, grouse and quail.

Similarly, exotic tree species like black locust produce little or no food and cover for native forest wildlife. Wildlife biologists often recommend a habitat management method known as "timber stand improvement." This usually involves removing the non-native species and planting native species like cedar, oak and walnut. Once established and mature, the native species should provide food and cover for white-tailed deer, wild turkeys and a host of other animals.

If these habitat methods are successful, population management may begin. One common population management method is deer harvest. Since their natural predators have been extirpated in Illinois, deer herds must be kept in check or face disease and starvation. Biologists manage deer populations by controlling harvest. The number of hunters allowed to receive a deer hunting permit is strictly controlled. Not only does this control the number of deer legally killed each year, but it can limit the number of hunters allowed to hunt a specific area.

At deer check stations, teeth in the lower jaw are examined to determine the age of each deer. From this information biologists can determine if the deer population is younger or older than previous years. This can be critical in determining the number of deer hunting permits issued the following year. At the deer check station, biologists may also collect blood to determine the health of the deer.

Deer jaw


17 months
Temporary premolars being replaced by permanent premolars
Third permanent premolar has two cusps
Permanent premolar

Management practices used for consumable species of fish, birds and mammals revolve around removing a surplus of animals through harvest to control the numbers of animals that could result in problems such as depredation or disease.

Mortality can affect a population in two ways. Compensatory mortality is the number of individuals that die each year from old age, predation, disease, starvation or other factors. Additive mortality results from factors introduced into the population that significantly raise the mortality rate above the normal range. If a population on a given site is very small, hunting may become an additive mortality factor.

All of nature exists in a complex of predator and prey relationships. Some wildlife populations have complex predator-prey relationships. Nesting hen (female) turkeys are vulnerable to attack from coyotes, foxes, bobcats and great horned owls. Once hatched, the young turkeys (polts) are vulnerable until they are able, at 10-12 days of age, to fly up to the lower branches of trees. Adult gobblers (males) are rarely preyed upon. In a simpler form, when cottontail rabbit populations are high, coyote numbers usually rise due to the abundance of this preferred food. When coyote numbers are high, rabbit populations will start to decline because more are caught and eaten.

Wild turkey

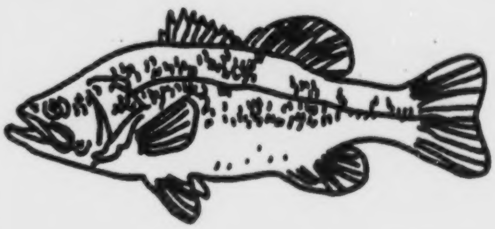
In a lake, crappies have cyclic population highs, which usually follow a peak in numbers of their prey. After several years, prey numbers usually decline and the crappie population crashes. A typical aquatic food chain starts with plankton, or microscopic life, which are fed on by aquatic insects which in turn are eaten by small fish. Large predatory species will in turn feed on the small fish. At some point in their life cycle, all fish compete for the same food. When young, all fish feed on zooplankton (microscopic animals). As they grow, the predatory fish switch and begin to prey on smaller fish.

In nature many organisms survive by producing large numbers of young. Any organism that serves the role as a prey species produces a lot of young so that some can survive to reproduce and continue the species. Species such as carp and northern pike lay their eggs and leave, providing no protection for their young. The lack of parental protection means that the likelihood of survival for these fish increases with the production of large numbers of eggs. On the other hand, members of the sunfish family including the largemouth bass produce smaller numbers of eggs and actually protect their young until they are about one inch long. When the young are large enough to function on their own, the parents often becomes predators, chasing and feeding on their own young. By dispersing their young in this manner, parents ensure that many will survive.

In a closed system, like a pond, too many bluegill may result from a lack of largemouth bass to feed on them. With large numbers present, bluegill become stunted and do not grow well. A large population of bluegill can affect the bass population by eating their eggs. This is an example of a system out of balance and, possibly, destroyed. To correct this problem, the stunted, overpopulated bluegill must be removed. In righting the imbalanced system, consideration must be given to the impact the proposed actions will have. For instance, if other species are introduced into the equation, the predator-prey relationship can become more complicated. The addition of crappies or walleye, also predators, places them in competition with bass for the same food items. Introducing bullheads to the system may result in a disrupted feeding cycle as bullheads root up vegetation and muddy the water. Sight feeders, such as bass and bluegill, are less likely to find food in muddy water.

Management of game and fish populations through regulation of hunting and fishing is often successful, especially if only one or two species are involved. For example, Canada goose hunting was strictly regulated from the late 1960s to the mid-1980s. Since then, these migratory birds have recovered to the point where annual harvest is an important management technique. Other fish and game management techniques include marked recapture and age-class structure studies to determine the range and reproductive rates of an individual or group of individuals in a given population.

Largemouth bass



One fisheries management technique is to limit the number of fish harvested through regulated timing and length of the fishing season. Establishing a minimum-sized fish that may be taken and setting a catch quota are other fisheries management techniques. Protecting or creating a spawning site or escape cover can ensure that populations are naturally sustaining. Managing surrounding land uses may prevent excessive runoff into a body of water. From this runoff, chemicals or excessive sediment could be introduced to the water system.

Chemicals may be intentionally introduced to a water system to fertilize nutrient-poor lakes. Chemicals also may prevent excessive growth of aquatic plants which would result in oxygen depletion and a fish die-off. Introduction of desired species from fish raised in a nursery may be used to stock unpopulated waters.

Woodland Plant Species Management

Management of individual woodland plant species is an uncommon practice in Illinois. In rare instances, management of an individual species such as white pine or walnut may occur. In these cases a single species is planted and managed for a harvestable product. In some instances the tree is harvested for the wood (walnut). Pine plantations may be managed for production of Christmas trees or wood fiber. Other species are left standing and the fruit (walnut seeds) is harvested annually.

Modern forestry practices in Illinois focus on management of the total forest ownership. Multiple species of plants and animals are considered in the development of management strategies. In effect, forestry management practices focus on the ecosystem which will include considerations of individual species' requirements. For instance a management plan could require creation of woodland openings, thereby providing sunlight needed for white oak regeneration and areas for ruffed grouse to brood and feed. Other management plans may recommend maintaining a closed forest canopy required by tree species that are shade tolerant. Hard maples thrive in a shady environment. Some species of songbirds, such as red-eyed vireos, scarlet tanagers and the ovenbird require large blocks of closed canopy forest for nesting and feeding.

Soil types and locations govern the type of species that will grow well in a specific location and must be considered in management plans. Each forest species has specific requirements that must be met for survival. White oak, an upland species requiring soils that drain well, will not thrive in bottomland wet soil. Black tupelo require an extremely wet soil, while blackjack oak require a sandy soil.

Over the years, fire has been viewed as a negative force on the forest community. The wildfires in Yellowstone National Park in 1988 and in California in 1993 show the destructive force of fire. However, fire in prescribed conditions can be a very effective management tool to control or manage forest species. As an example, fire can be used to control an undesirable species such as soft maples invading an oak-hickory forest. Fire can also be used to stimulate growth of a species such as the bur oak that is commonly found in prairie savannas or the jack pine that requires fire for regeneration.

Forest trees are a renewable natural resource. Proper management of the trees within the forest will provide a continuous source of recreation, wildlife habitat (food and shelter), aesthetics, wood fiber and watershed protection. Even though an individual tree may be harvested or die, the forest will continue to thrive. A growing forest produces adequate seed for reproduction and food for wildlife, takes in carbon dioxide to clean air and produces oxygen. An over-mature forest will start producing less seed, use less carbon dioxide and produce less oxygen.

Exotic Species Management

An *exotic* species is a plant or animal that has been introduced to an area outside its native range (figure 3). Control of exotic species may not be desired, where the species provides sufficient benefits. In other instances, control may not be possible, given the extent of the population and the type and expense of control techniques proven effective. When control of an exotic species is determined to be effective and necessary, techniques may include quarantine or eradication. Biological controls may also be used, such as introduction of a virus, bacteria or insect that is detrimental and specific to the exotic species or the use of some type of a sex attractant or sterilant.

Figure 3

EXOTIC SPECIES IN ILLINOIS

zebra mussel, Japanese beetle, gypsy moth, mosquito fish, trout, salmon, goldfish, carp, house sparrow, rock dove, starling, ring-necked pheasant, house mouse, Norway rat, autumn olive, purple loosestrife, Japanese honeysuckle, kudzu

Projects and Activities:

1. Have students identify and describe some causes for extinction of animal species and name threatened and endangered animals living in their area using the Project WILD activity "Here Today, Gone Tomorrow" (see "A Closer Look").
2. Using the Project WILD activity "Deer Crossing" (see "A Closer Look"), have students analyze and evaluate complex factors that frequently arise in wildlife management issues. Discuss management issues that arise for other species such as Canada geese, endangered species or game fish.
3. Have students interpret and make inferences about fluctuations in fish populations from actual data presented in the Project WILD Aquatic activity "Where Have All the Salmon Gone" (see "A Closer Look").
4. Have students role-play managing a tree farm and consider the economic factors that influence management decisions by participating in the Project Learning Tree activity "Forest for the Trees" (see "A Closer Look").
5. Discuss with students the various careers associated with habitat or species management (see "A Closer Look"). Have students select and research a specific career. Organize the students into small groups that might logically form a business dealing with the habitat or species. Have them outline the type of work they would conduct and the clients they feel would utilize their services. Then the group should write and design a brochure to promote their business.

Evaluation:

1. Using information obtained from the Endangered Species Protection Board or the Illinois Department of Conservation, plot the locations of endangered and threatened species on an Illinois county map. Research the species to determine what features have caused them to be classified in this manner. Compare the distributions to the map of the 14 geographic or natural divisions of Illinois. What conclusions can be drawn about the distribution of some species?
2. Observe aquatic life using hand lens or microscopes to determine the types of species present in various types of water bodies. What differences are noted? Why do the differences occur?

Extensions:

1. Invite a natural resource professional or team of professionals to your classroom to discuss species management practices in Illinois. Types of professionals you may consider are Illinois Department of Conservation (heritage biologist, wildlife biologist, fisheries biologist, forester, hunter or trapper safety education specialist), U.S. Forest Service—Shawnee National Forest, The Nature Conservancy, U.S. Fish and Wildlife Service, Forest Preserve District staff, Conservation District staff, constituent groups (Audubon, Ducks Unlimited, Pheasants Forever, B.A.S.S., Izaak Walton League and others).
2. Research an exotic species to determine where it occurs naturally and when it was introduced to the United States and Illinois. Has the exotic species become a problem and if so, how? What species does it compete with? What techniques can be used to control the exotic?
3. Have students prepare a field data collection sheet which they can use to tally the major life forms (plants, insects, other invertebrates, fish, reptiles, amphibians, birds, mammals) seen or heard on a habitat safari. If time permits, repeat the safari at different times of the year or day. Discuss their findings. Why did they see many or few individuals in each category? Graph the numbers seen by each student or team of students.

Vocabulary: census, estimate, exotic, electroshock, seining, gill netting, niche, prescribed fire, exotic

Resource Conservation
Unit 3
Lesson 2

Teacher's Guide

SUGGESTED GRADE LEVELS: 7-10
SUBJECTS: Science, Social Science, Language Arts, Math
SKILLS: mapping, graphing, presentation, role playing, comparison, research, data collection, identification, predication, analysis, evaluation, inference, interpretation, communication, problem solving, decision making
CORRELATION TO STATE GOALS FOR LEARNING:
Science (1,2,4), Social Science (2,4), Language Arts (1,2,3,4), Math (4,6)

Habitat Management

Objective: Students will recognize the five major habitat types found in Illinois and apply knowledge gained from review of the historical perspective, ecological and economic importance, management practices and current issues related to each.

Background: This lesson plan discusses management techniques used on the five most common natural communities in Illinois: forest, grassland/prairie, wetland, urban and rivers and streams. A natural community is a grouping of plants and animals that live together under similar environmental conditions. Soils, glaciation and past climatic changes determine the type of natural community present and, therefore, the representative plants and animals of the community.

Illinois has 14 geographic or natural divisions (figure 1). These divisions are based on the bedrock, glacial history, topography, soils and distribution of plants and animals. Further separation of areas based on these characteristics creates 33 sections. Briefly, the 14 divisions are as follows:

Wisconsin Driftless Division - northwestern Illinois and Wisconsin, Iowa and Minnesota; rugged terrain due to lack of glaciation; coldest climate in Illinois, therefore, some plants and animals are typical of northern areas and preglacial habitats.

Rock River Hill Country Division - Rock River drainage area in northwestern Illinois; rolling topography, historically with prairies on level uplands and forests along streams and rivers.

Northeastern Morainal Division - northeastern Illinois; most recently glaciated section of the state, as evidenced by the lake-bed deposits, beach sands, dunes and bogs.

Grand Prairie Division - largest division; historically the tallgrass prairie area with interspersed marshes, prairie potholes and forested borders along rivers and streams.

Upper Mississippi River and Illinois River Bottomlands Division - the rivers, bottomlands and backwater lakes of the upper Mississippi and Illinois rivers and their tributaries; historically forest.

Illinois River and Mississippi River Sand Areas Division - sand areas and dunes in the bottomlands of these rivers.

Western Forest-Prairie Division - a strongly dissected glacial till plain which was forested with prairies on the level uplands.

Middle Mississippi Border Division - narrow band of river bluffs, limestone cliffs and rugged terrain along the Mississippi and lower Illinois river floodplains; rugged topography due to the lack of glaciation.

Southern Till Plain Division - dissected glacial till plain with poor soils; forest and prairie predominant historically; second largest division across much of southern Illinois.

Wabash Border Division - bottomland forests of the Wabash river and its tributaries.

Ozark Division - mostly forest with some hill prairies; caves, sinkholes and glaciated sandstone ravines are typical features.

Lower Mississippi River Bottomlands Division - Mississippi River floodplain from Alton to Thebes Gorge; pre-settlement vegetation included prairies, marshes and forest.

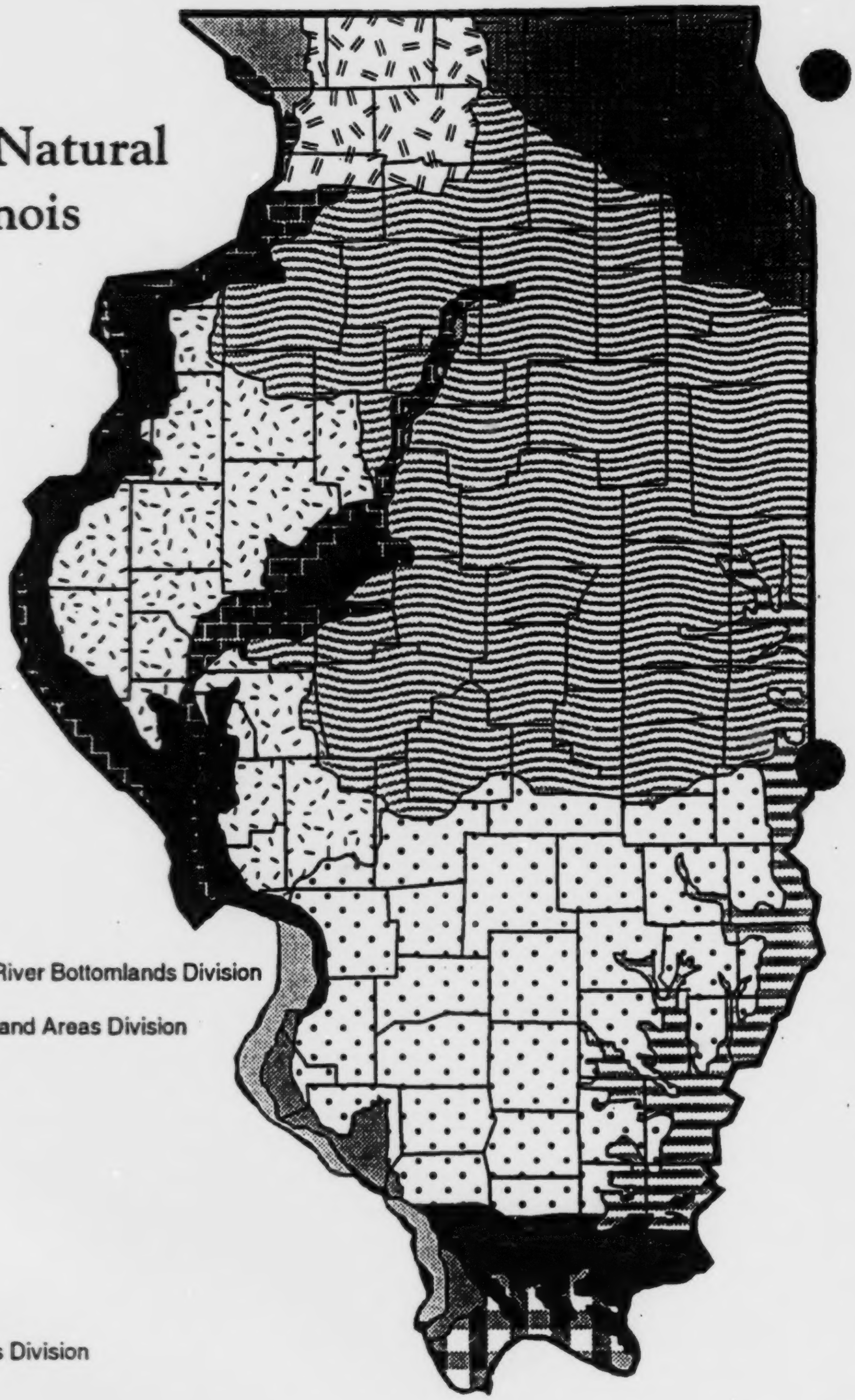
Shawnee Hills Division - southern tip of the state; forest, unglaciated hill country with sandstone cliffs.

Coastal Plain Division - a region of swampy forested bottomlands and low clay and gravel hills in the extreme southern portion of the state.

The environment that a plant or animal lives in is called its *habitat*. Habitats contain four basic components necessary to thrive and survive. Food, water, cover and space must be present and appropriately arranged. If any component is missing or has been altered, the plants or animals will be affected.

Figure 1

Map Of The 14 Natural Divisions Of Illinois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Ozark Division
Lower Mississippi River Bottomlands Division
Shawnee Hills Division
Coastal Plain Division

A natural community that remains relatively undisturbed by humans is called a natural area. Less than 0.07 of 1 percent of Illinois remains in this condition.

Habitat management may achieve a single objective such as managing for an endangered or threatened species. Multiple use management plans may be made, such as managing a forested park to provide wildlife habitat and recreational opportunities. The practices selected will vary depending on the management objectives.

Forest

DEFINITION A forest may be an area containing at least 16.7 percent forest trees. The trees may be of any size. Forests may also be land formerly having such tree cover and not currently developed for non-forest use. Twenty-four percent of the earth is covered with three types of forest communities—tropical deciduous forests, temperate deciduous forests and evergreen coniferous forests. Approximately 60 percent of the world's forests are found in four countries—former USSR (28 percent), Brazil (13 percent), Canada (9 percent) and United States (7 percent).

The major classifications of forest types in Illinois are oak-hickory, cottonwood, maple-beech, elm-ash-soft maple, oak-gum-cypress, oak-pine, shortleaf pine and white pine. About one-half of the forest acreage in Illinois of commercial quality is of the oak-hickory classification. Maple-beech (1/4) and elm-ash-soft maple (1/6) are the other major commerical forest types in Illinois. All remaining forest types total 216,800 acres.

A climax forest is able to reproduce itself in its own shade. Climax forests in northern Illinois are composed of sugar maple. In southern Illinois, maple and beech are the prominent species in climax forests. A transition forest occurs when trees start invading a grassland, but before it becomes a climax forest. Oaks and hickories are common transition species. The amount of transition forest has increased fortyfold in southern Illinois.

HISTORICAL PERSPECTIVE At the time of European settlement, about two-fifths (13.8 million acres) of Illinois was forested. About one-quarter of that acreage remains, but only 13,500 acres are relatively undisturbed. Today, farmers own 45 percent of Illinois forest land, followed by non-farming private individuals (38 percent), federal government (7 percent), private corporations (6.5 percent), state government (1.4 percent), county and municipal governments (1 percent) and the timber industry (.3 percent).

Forests can be classified as *old growth* (minimum disturbance) or *second growth* (disturbed). Since 1620, over 95 percent of the original forests in the contiguous 48 states has been greatly disturbed or cut for wood products. The giant sequoia and redwood forests found along the West Coast are classified as old growth forests. Less than 0.3 percent of the forest acreage in Illinois has been classified as high-quality natural areas. Less than 150 sites of high-quality forests remain in Illinois and are present in 56 of the 102 counties. Many of these areas continue to be jeopardized by the invasion of exotic plants, such as amur and tatarian and Japanese honeysuckle. Some of the larger forested natural areas in Illinois are Gardner Woods (Adams County), Beall Woods (Wabash County), Forest Park Nature Preserve (Peoria County), Funks Grove (McLean County), Little Black Slough (Johnson County), Norris Woods Nature Preserve (Jefferson County), Redman's Forest (Clark County) and Sonneman Woods (Fayette County).

Secondary growth forest may result from harvesting trees or as a natural successional process following abandonment of agricultural land. The Shawnee National Forest in southern Illinois is a prime example of this conversion.

ECOLOGICAL IMPORTANCE The values of trees are immeasurable. More than 250 million people reside in the world's tropical rainforests. Ecological benefits of trees include erosion control, wildlife habitat, oxygen, reduction of air pollution, increased soil fertility and returning water to the atmosphere. Urban land use planners recognize the value of trees to buffer noises. In addition, the aesthetic qualities of forested lands have considerable positive psychological benefits.

All life depends on oxygen. Oxygen is a byproduct of the photosynthetic process that plants undergo to convert water, sunlight and minerals to food. Through transpiration and evaporation, plants return moisture to the air. These same processes filter impurities from the air, thereby reducing the levels of some forms of air pollution.

The potentially erosive effects of rains are lessened by trees. The canopy of vegetation slows the speed at which raindrops hit the forest floor. The network of plant roots hold forest soils and allow rainwater to be slowly absorbed. This decreases the potential for severe flooding and helps springs, aquifers, rivers and ponds recharge. All these factors decrease the amount of sediment that washes from forested areas into water bodies.

Forests support the greatest number of individuals and the greatest diversity of wildlife species. In excess of 50 percent of the world's species depend on forests. More than 420 vertebrate species are dependent on Illinois forests. More than 260 species of native trees and 285 species of native shrubs are found in Illinois forests.

Economic Importance By 1870, 92 counties in Illinois had industries dependent on wood products, making up

30 percent of the work force. Today, 55,000 people work in forest-related industries, with a payroll of $1 billion. Illinois ranks thirty-second in production and fifth in consumption of timber products.

Forests provide an estimated $150 billion of wood products annually. Hundreds of food products are harvested from trees, including nuts, fruits, chocolate, syrup, rubber, spices, dyes, oil and coffee. Native Americans and pioneers recognized the medicinal values of plants, such as the aspirin found in the bark of willow, antiseptic in the bark of white oak, fungicide in the butternut (white walnut), oil and expectorant from white pine tar. Today, more than one-quarter of the world's drugs have a connection to a plant found in tropical rainforests.

Trees are the lungs of the earth

Forests are also economically important for the recreational opportunities that take place on private and publicly owned lands. Hunting, camping, picnicking, birding, mushroom hunting and hiking are a few forest-related recreational activities that may provide economic return.

A forest ecosystem is not only composed of trees, but also shrubs, decaying trees, grasses and wildflowers. Grazing can impact the young trees that would eventually replace the mature trees. Cows, horses and pigs that graze a forest compact the soil. Animals walking through the forest kick up the protective layer of grasses, wildflowers and dead leaves, increasing erosion. Managers recommend fencing selected woods from grazing. Large populations of deer may impact a forest by browsing, or eating leaves and buds within their reach. In some woodlands, a distinct horizontal line can be seen 5-6 feet above the ground, the maximum reach of a deer.

MANAGEMENT PRACTICES When foresters conduct an inventory of forest land, they most commonly collect data on the types of species present and the volume and number of trees. They also are interested in learning annual tree growth rate, the size and age classes of various species, amount of woody biomass (energy potential) and mortality rate.

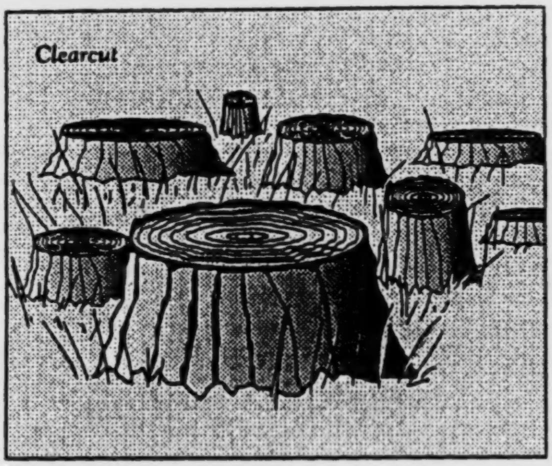
A variety of forest management practices are utilized. Selection of techniques used are based on the management objectives. Some forests are managed with a "hands-off" approach, where nature proceeds on a natural course. Wilderness areas are one example of this management style. These areas follow guidelines set in the Wilderness Act of 1964. To qualify, proposed wilderness areas west of the 100th meridian must be more than 1 million acres in size and relatively free of degradation. The primary objectives are to maintain diverse biological reserves of plants and animals and provide recreation and research opportunities. Sites east of the 100th meridian do not have to be as large or pristine. Eastern wilderness areas emphasis recreation, watershed protection and threatened and endangered species. Wilderness areas may be managed for restoration of native natural communities or if Congress declares that the resources contained on the property are needed for the good of the country. Less than 5 percent of the United States if formally recognized as wilderness. In Illinois, nine wilderness areas have been established. These sites are in the Shawnee National Forest and total 26,200 acres.

Other forest management practices include varying degrees of harvest, insect and disease control, and prescribed fire. Timber stand improvement (TSI) is a management practice involving the selective harvest of mature, over mature or defective trees. This harvest will improve the overall health of a timber stand. Often this management practice provides more sunlight, moisture and nutrients than nearby saplings require.

Forests managed to allow harvest can be *even-aged* or *uneven-aged* management techniques. Even-aged management is a growth and harvest cycle. Periodically a portion of the forest will be cut. A few trees will be left to benefit wildlife and provide seed trees and aesthetic values. The trees that grow to replace the mature trees harvested will be the same age.

Uneven-aged management creates a forest with three or more age classes of trees. This management technique creates a forest having large, medium and small trees at the same time. Only a few trees or clumps of trees are harvested at any one time. This process is repeated periodically, creating a continuous process of harvest and regeneration.

Several types of cutting practices are used in even-aged forests. A *clearcut* removes all the trees in a specific area. A *shelterwood cut* requires that forty to sixty percent of the trees be removed. New trees can then grow in the partial sunlight and be sheltered by the remaining, older trees. Removing all but a few well-spaced seed-producing trees is a ***seed tree cut***. Two cutting practices are used to maintain an uneven-aged forest: ***group selection*** and ***individual tree selection***. Cutting a group of trees in a one-quarter to two acre cluster is a group selection. These openings increase sunlight and create areas for regeneration of trees. Cutting individual trees of various sizes is an individual group selection. This management style creates small openings that shade-tolerant species can grow in.



The need to manage forests for insect and disease outbreaks usually occurs if the forest is unhealthy composed of a single species of trees or if an exotic insect or new disease is introduced. Management techniques may include removing problem trees or applying an antibiotic, herbicide or insecticide. Clear-cutting and burning the affected trees are additional management options. As a longer term management option, research foresters work to develop genetically improved trees or a strain of tree that is disease or insect resistant.

Fire is a natural process that some species of trees (pines) and wildlife habitats depend on to maintain themselves. ***Prescribed fires*** are used to reduce the amount of litter that accumulates on the forest floor. These intentional fires also are designed to reduce the likelihood of a hot fire, or one that burns for a longer duration and destroys more trees. Fire is also a tool available to manage an outbreak of disease or insects.

Use of fire as a management tool requires considerable planning and training. Prior to a prescribed fire in Illinois, biologists or foresters prepare a burn plan. The plan must contain site-specific objectives for the use of fire. A description of the known or probably adverse effects to federal or state endangered or threatened species must also be prepared. Finally, known elements needed to achieve the objectives of the fire in a safe manner must be identified.

The time prescribed burns can occur is strictly controlled. Most prescribed burns are conducted between the first freeze in the fall and before growth or ground nesting activity in the spring. Long-term climatic data are used to schedule prescribed burns, as well as the experience biologists and foresters have had with other fires.

ISSUES Current issues related to forest communities include the harvest of a renewable resource to provide wood products and employment or preservation of the resource and protection of wildlife and habitat. In some instances, endangered and threatened species may inhabit forests scheduled for harvest. The spotted owl along the west coast and the nesting habitat for Swainson's warbler in southern Illinois are two examples. The impacts of exotic species on forest communities can be another forest issue. Black locust, garlic mustard, honeysuckle and winged wahoo (burning bush) alter communities and crowd out native plants. Another current issue related to forest habitats is the presence of adequate winter and breeding habitats for migratory birds. An issue affecting land management agencies is the lack of fiscal and manpower resources to effectively manage timber resources.

Wetland

DEFINITION A wetland is defined as "areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstance do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (U.S. Army Corps of Engineers and U.S. Environmental Protection Agency). The major wetland communities found in Illinois include ***perennial streams***, ***intermittent streams***, open lakes, lake shores, ponds, scrub-shrub wetlands, swamps, forested wetlands, wet meadows, ***fens***, ***marshes*** and ***bogs*** (figure 2).

The presence of water can be used to locate wetlands. However, seasonal fluctuations in water levels due to natural variation in weather and water control devices such as dams and drainage ditches may make this an unreliable identification tool. A more reliable factor to identify wetlands is the presence of a hydric soil. These soils are distinguished by their color, texture and the presence of water. Wetlands are also identified by the presence of water-dependent, or ***hydrophytic***, plants. Cattails, swamp primrose, bald cypress, buttonbush, pondweed and willow are examples of hydrophytic plants.

HISTORICAL PERSPECTIVE Wetlands once covered more than 8.2 million acres throughout Illinois. Prior to European settlement, Illinois had 0.2 million acres of water. Many population centers were not habitable until wetlands were drained, removing the threat of malaria and other related diseases.

Figure 2

WETLAND CHARACTERISTICS

Perennial Stream - water contained within a channel and flows throughout the year
Intermittent Stream - water contained within a channel but flows only part of the year
Open Lake - area greater than 20 acres
Lake Shore - formed by active, wave-formed bedrock shoreline
Pond - area less than 20 acres with no wave action or bedrock shoreline
Scrub-Shrub Wetland - more than 50% of the vegetation is woody but less than 20 feet tall
Swamp - more than 50% of the vegetation is woody, adapted to living in water and greater than 20 feet tall; surface water usually present
Forested Wetland - more than 50% of the vegetation is woody, not able to survive prolonged inundation and greater than 20 feet tall; surface water present seasonally
Wet Meadow - more than 50% of the vegetation is herbaceous; standing water present seasonally during growing season; neutral pH
Fen - greater than 50% of the vegetation is herbaceous; standing water present; soil alkaline pH
Marsh - greater than 50% of the vegetation is herbaceous; standing water present; soil neutral pH
Bog - greater than 50% of the vegetation is herbaceous; standing water present; soil acid pH

Illinois is one of seven of the continental states that has lost in excess of 80 percent of its wetlands. Specifically, Illinois has lost more than 90 percent of the original wetlands. Today, only 6,000 acres of high-quality marshes, forested swamps and peat bogs remain in Illinois. More than 35 percent of the federal threatened and endangered species rely directly or indirectly on wetlands. Forty percent of Illinois' threatened and endangered species are classified as wetland-dependent species during some part of their life cycle.

In the nation, over half of the original 200 million acres of wetlands have been lost. It is estimated that the 90 million remaining wetland acres are lost at a rate of one-half million acres each year.

The number and quality of wetlands is declining because wetlands are drained or filled for agricultural, industrial and urbanization purposes. Pollution, siltation and invasion of exotic plant species are also affecting wetlands.

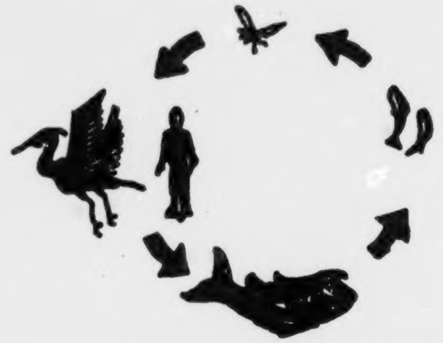
ECOLOGICAL IMPORTANCE Wetlands provide numerous benefits to wildlife and humans. These diverse and biologically productive areas support large numbers of plant and animal species, from cattails to bald cypress and from waterfowl, furbearing mammals and fish to shellfish. These enriched waters also support many aquatic invertebrates. These organisms form the base of the wetland food chain that includes species such as bluegill, herons, eagles, raccoons and river otters. Some animals depend on wetlands for their entire life cycle. Other species seek seasonal food or cover in wetlands.

Wetlands collect surface water and store flood water, helping to decrease flooding impacts downstream. Stored water is also slowly released into the groundwater system where it is then accessible for use through aquifers, springs and wells. Micro-organisms in the soil and water help purify water by breaking down chemicals and organic wastes.

Wetlands that occur between a river and higher ground buffer the soil from erosion. When slowed through passage through a wetland, the silt load carried by water often settles to the bottom of the wetland.

Students and researchers in the biological sciences use wetlands as laboratories for studies of natural resources and water.

Aquatic Food Chain



ECONOMIC IMPORTANCE Wetlands are economically important. They decrease property damage by storing flood waters. Wetlands provide food, purify water and offer opportunities to pursue a variety of recreational activities. Nationally, the fish harvested from wetlands contribute $10 billion to the economy. More than $300 million is spent annually by waterfowl hunters in pursuit of wetland-dependent birds. More than $70 million of income is realized from the sale of muskrat pelts. Each year, an estimated 50 million people observe and photograph wetland-dependent birds, spending nearly $10 billion in the process.

MANAGEMENT PRACTICES Wetland management can involve manipulation and protection. Some wetland management has involved drainage to "reclaim" wetlands for human uses. Other manipulations enhance recreational opportunities such as hunting and fishing. Some management practices encourage succession, while others strive to prevent conversion of the wetland to another habitat type. Acquiring or dedicating land may also be used as wetland management tools.

A wetland may be managed to enhance ground water recharge and discharge or to alter the flow of flood water. Erosion along the wetland may require revegetating the shoreline. Removal of sediments, toxins and nutrients may be required. Aggressive management may be undertaken to control the invasion of exotic plants (purple loosestrife) or to preserve the integrity of the habitat for nesting waterfowl, herons or bitterns.

A number of factors are considered when managing a wetland for biological diversity. A larger wetland promotes higher bird diversity. The proportion of water to vegetation may be a consideration. Higher bird diversities are associated with relatively equal amounts of water and vegetation. A diversity of vegetation provides richness that supports breeding, feeding and cover of animals. Increased biological diversity can also provide for diversity of recreational activities and enhance the aesthetic qualities of the site.

Mitigation banking is a wetland management option which permits a developer to compensate for future wetland impacts through the restoration, creation, enhancement or preservation of wetlands. One disadvantage of this technique is that the scientific and technical expertise of these practices is limited. On the other hand, banking provides opportunities to develop a new wetland prior to destroying the original wetland and to create larger wetlands than originally existed. In Illinois, wetlands have been created on lands formerly used for extraction or processing of stone (quarry) or coal (mine slurry pond).

ISSUES Wetlands serve a wide range of functions; however, if we require the habitat to do more than the system can handle, we can destroy the habitat. Wetlands serve a positive function in filtering sediments and toxins from water. When subjected to vast amounts of sediment, wetlands become filled and are converted to other habitat types. An abundance of sediments can choke aquatic organisms.

Exotic species such as purple loosestrife, water hyacinth and nutria can severely impact wetlands. Brandendberg Bog has been destroyed by purple loosestrife. Pollutants derived from fertilizer runoff and septic waters decrease water quality and the number and diversity of plants and animals residing in the wetland. When wetland communities are not managed properly, furbearer species (beaver, muskrat) may become too numerous and destroy associated vegetation or cause flooding. The level of water in wetlands must be managed to maximize the ability to store flood water. Wetlands are commonly drained to permit conversion for agricultural or development purposes.

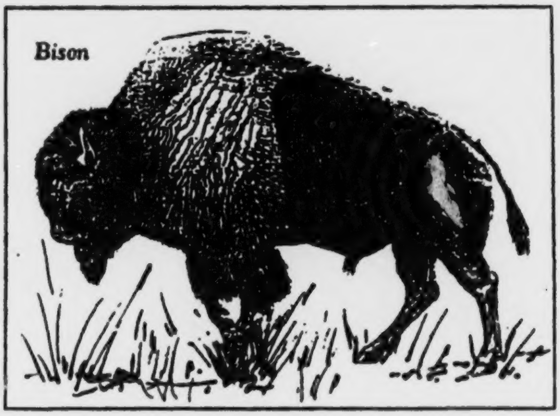
Grassland/Prairie

DEFINITION Prairies are composed of grasses and broad-leaved plants called *forbs*. A number of prairie types exist in Illinois and are separated by the amount of moisture in the soil. *Mesic*, black soil prairies were the most common historically. Other prairie types include sand, dolomite, loess and glacial drift hill.

HISTORICAL PERSPECTIVE At the time of settlement nearly 22 million acres of Illinois were covered with prairie. All but nine of the 102 counties contained a large amount of prairie. As settlers crossed North America, Illinois was the first area where they encountered large expanses of prairie. As a result, Illinois was nicknamed the "prairie state." Life on the prairie was not easy for these early settlers. They had to contend with large numbers of biting insects, hot summers and cold winters. The tall grasses and treeless horizons obscured visibility and lacked landmarks. Droughts and fires often meant loss of crops and livestock.

Free-roaming bison produced a salivary enzyme which was left on prairie grass as they grazed. Before the settlement of Illinois, this enzyme, along with periodic fires, helped keep the prairie healthy by promoting new growth. Wild bison have been *extirpated* from Illinois. The majority of the long grass prairie has been converted to farmland. Shortgrass and bunchgrass prairie have also been converted to ranch land for cattle. In short, all of these factors have combined to cause less revegetation and more erosion.

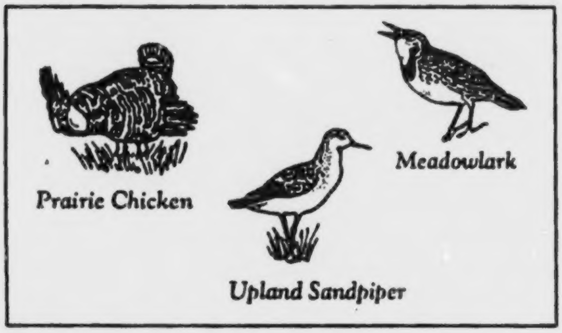
Bison



Farmers found the prairie soil to be more fertile than forest soils. The slow process to convert prairies to agricultural production began. This process was sped considerably with John Deere's invention of the self-cleaning plow in 1837. Conversion of prairies continued with Illinois losing most of this habitat by 1900.

Prairies were most commonly found on flat, level ground. Today, only about 2,300 acres of Illinois' original prairie remain relatively undisturbed. Most typically, prairies are found in old cemeteries, along railroad rights-of-way and areas unsuitable for farming. Representative communities in Illinois are Goose Lake Prairie Nature Preserve (Grundy County, largest remnant of prairie left in Illinois); Gensburg-Markham Prairie Nature Preserve (Cook County, dry-mesic, mesic and wet-mesic sand prairie); Wolfe Road Prairie (Cook County, tallgrass prairie and savanna); Sand Prairie-Scrub Oak Nature Preserve (Mason County, dry sand prairie and forest); and Fults Hill Prairie Nature Preserve (Monroe County, loess hill prairie).

ECOLOGICAL IMPORTANCE Prairies were important habitats for a diversity of wildlife. A variety of ground-nesting birds such as the prairie chicken, meadowlark and upland sandpiper lived on prairies. Many birds of prey circled overhead in search of food. Northern harriers, red-tailed hawks, short-eared owls and turkey vultures were commonly seen over the prairie.



Insects make up more than half the living things on Earth. Millions of individual insects may potentially occur on prairies. Not only do insects provide an important food source for other prairie inhabitants, but they also serve to pollinate plants, decompose plant and animal material, and till the soil.

Native Americans and settlers relied on the large mammals that roamed the prairie. Bison and elk provided food and materials for homes and clothing. Other large animals such as the black bear, mountain lion, bobcat and wolf once roamed the grasslands. Smaller mammals burrowed in the soil, eating insects and other small mammals. Badgers, Franklin's ground squirrels, prairie voles and plains pocket gophers served in this role. Their *fossorial* habits aerated the soil.

ECONOMIC IMPORTANCE Beneath the surface of a prairie lies soil and an immense system of roots called sod. The roots of compass plant and leadplant, both prairie forbs, extend more than 10 feet below the surface. Grasses, such as big bluestem and switchgrass, can be found to depths of 5 feet or more. Through decomposition, nutrients in dead roots rot and return nutrients to the soil. More than 641,000 fungi and 20 million bacteria have been recorded in an acre of prairie soil. These decomposers produce the rich soil that extends the depth of the prairie plant root system. This is the soil, or ***humus***, that makes Illinois a leader in agricultural crop production.

MANAGEMENT PRACTICES Fires were common on the prairie. Native Americans used fire to direct large numbers of bison toward hunters. Fires remove the dead layers of grass (thatch) that accumulate on the surface and prohibit new plants from pushing through the dense mat. Nutrients are released by fire and the cycle begins anew in young plants. Fires also keep invading and undesirable young trees from growing and shading out prairie grasses and forbs. Today, like those once started by Native Americans, intentionally set fires, called prescribed burns, are used to maintain a prairie.

Control of exotic plants is an important management activity for the prairie manager. Mowing, herbicides, hand removal and fires are all used to eliminate potentially damaging species such as bluegrass, sweet clover, black locust and rough-leaved dogwood.

ISSUES Exotic herbaceous and woody invaders commonly threaten prairies. Sweet clover, groundvetch and Johnson grass are expensive to control once they have invaded a prairie. Multiflora rose is a management issue in pastures. Exotics crowd out native plants, destroying the habitat and altering the community. Some citizens are concerned that prescribed burns will result in air pollution and a loss of wildlife.

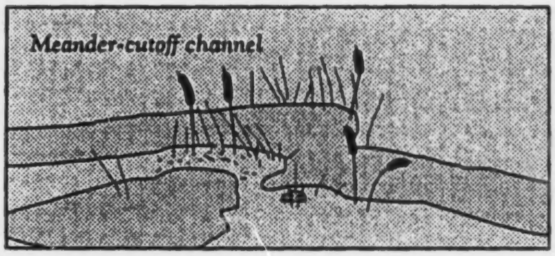
Lakes and Streams

DEFINITION Lakes and streams are types of wetlands. Lakes are usually classified as deepwater habitats that are present in a depression or a dammed river channel. Lakes differ from ponds in the diversity of habitat types for aquatic organisms. From an ecological standpoint, lakes are 6 acres or larger and have vegetation covering less than 30 percent of the area. Illinois lakes and streams are considered freshwater bodies, ideally having less than 0.5 parts per thousand (ppt) of salt.

Rivers and streams are deepwater habitats contained within a channel. If water flows through the channel throughout the year, the river or stream is called a perennial stream. An intermittent stream has water flowing only part of the year. The smaller streams that feed into larger rivers and streams are called *tributaries.* The land adjacent to a river or stream that is periodically flooded is called the *floodplain.*

Every river and stream has a ***watershed or drainage basin.*** This is the total land area that provides water to the river or stream. Along with the surface water runoff, these bodies of water receive sedimentation and other materials from the watershed. Many rivers rely on flooding to increase productivity and enrich floodplains with rich sediment and nutrients. Changes to the Mississippi and Illinois Rivers such as levees and locks and dams have diminished the natural flooding cycle and reduced productivity of these systems.

Meanders (curves) form in older, slower flowing streams as their channels migrate along the path of least resistance. During floods, the additional volume and velocity of water will often cut-off the meander, forming a *chute.* As the flood subsides and the water loses velocity, sediment drops out of the water column. Sediments may form a sandbar, creating a natural dike between the chute and the old meander. Thus, an oxbow lake is formed where the meander used to be. The sediment that is left behind during these natural stream migrations is caused ***alluvium.***



HISTORICAL PERSPECTIVE Illinois has been part of the central lowland of the North American continent for at least the last 300 million years. The ice age some 2 million years ago had major impacts on Illinois and its rivers. Glaciers blocked and buried some rivers and created new ones. Ancient rivers, such as the Teays, Cumberland, Paw Paw and Ticona no longer exist. The Missouri River once flowed in much of what is now the Mississippi River bed, but was blocked and filled during the Kansan (second) glacier and diverted to a new channel. The Teays River was diverted south of the glacier and became the Ohio River.

The French furtraders of "coureur de bois" were the first known whitemen to set foot from Illinois' water to her soil. Like Native Americans and other European explorers of their time, these robust frontiersmen traveled by canoe in Illinois for three reasons. First, it was the best and most efficient way to find, establish and operate trade routes. Second, water provided them with immediate access to their primary means of income—beaver pelts. Last, rivers helped protect them from the uncertainties of the wilderness.

Not surprisingly, Illinois' recorded history began on June 20, 1673, with the French explorers Louis Joliet and Pere Marquette. On that date they paddled their supply-laden canoes past the rugged hills of present-day Galena in search of a trade route to the Orient. Meanwhile, furtraders, frontiersmen and other French explorers went about the business of settling the "prairie state." Forts, such as Creuve Coeur, St. Louis, Kaskaskia and DeChartes were built by the French to protect their hard-won discoveries. Villages sprung up and more settlers moved in along the banks of such rivers as the Illinois, Rock, Vermilion, Mackinaw, Kaskaskia and Sangamon. Eventually, the fur trading boom died and Illinois, with a "sea of grass and the smell of distance in the air," fell to the mold board plow. Today, places like Ottawa, Joliet, Peoria and LaSalle still bustle with the sounds of a different kind of commerce. Our lives, however, remain inextricably tied to Illinois water.

ECOLOGICAL IMPORTANCE All life depends on water for survival. Animals must have water to maintain normal body temperature and other physiologic functions. Plants must have water to perform photosynthesis and maintain *turgor* pressure. Even bacteria and fungi need water to survive.

Many of the river backwaters, deep glacial lakes and prairie potholes historically found in Illinois have been drained or seriously disturbed. More than 25,000 miles of streams exist in Illinois. More than half have been degraded in some manner—dredging, damming, pollution, siltation or presence of exotic plants, fish or mussels.

Many rivers rely on flooding to increase productivity and enrich floodplains with sediment and nutrients. Changes to the Illinois and Mississippi Rivers such as levees, locks and dams have diminished the natural flooding cycle and reduced productivity of these systems.

ECONOMIC IMPORTANCE People rely on water in more diverse ways than plants or animals do. For example, not only do we need water to drink, but we use water to clean ourselves and homes. Water in the form of ice cools our food and beverages. Our gardens and lawns are watered to improve productivity and be aesthetically pleasing. The agricultural industry often supplements rainfall with water pumped through irrigation systems. Water is a necessary component of many manufacturing processes.

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Water is the cornerstone of much of our recreation—from boating, canoeing or fishing to skiing, scuba diving and swimming. Fishing, hunting and trapping of aquatic life provide recreational opportunities and supplement the table with food and may provide fur for clothing. Many rivers, streams and lakes attract tourists and support area businesses.

River corridors continue to be used for shipping produce and manufactured goods downstream. Rivers and streams dammed to create a reservoir may provide recreational opportunities, generate electricity, supply homes and agricultural lands with water, and store flood waters. Damming of rivers and streams does, however, result in the loss of almost all the habitat features and amenities which depend upon and are produced by flowing water.

Erosion is a natural process. Soils can be eroded and moved downstream by wind, rain or glaciers. Many of the human practices accelerate the erosion process. Soil particles can be picked up by wind or water when trees are cleared or prairie grass or other terrestrial herbaceous vegetation is removed, either by people or when cattle overgraze the site. Soil particles in water can kill bottom-dwelling organisms, clog the gills of fish and mussels and destroy the fish spawning habitat. Herbicides, pesticides and other chemicals attached to soil particles can kill or severely injure populations of aquatic organisms.

Removal of sediment is a costly process. Navigational channels must be periodically dredged to maintain an area for barges transporting products and travel. Destruction of vegetation in a watershed may result in erosion and the filling of a lake or reservoir. As a result, the water body may have diminished appeal for recreation. A decreased capacity for water storage provides less water for human, agricultural or industrial use or for flood storage.

MANAGEMENT PRACTICES Management of lakes and streams requires protecting habitat essential to the aquatic organisms. Activities within the watershed greatly affect the quality of water. Controlling erosion includes minimizing the amount of soil that is exposed to air and water. Projects and activities should be designed to minimize the amount of soil disturbed. Conservation farm practices may include covering the soil, leaving a crop residue or revegetating the area.

Protection of aquatic resources may require zoning to prevent construction along the banks of the water body. Water pollution is categorized as non-point (from a land practice such as agriculture or construction), municipal (wastewater and storm runoff), industrial (chemical discharge from industry) and dredging (removal which also stirs up sediment). Water quality can be improved by minimizing the amount of activity leading to any and all of these types of pollution.

Aquatic resources may also be managed by enhancing the resource. Placing escape and spawning structures, such as brush piles and tire reefs, may replicate natural conditions in lakes. In streams, wing dams may be built from the bank. Water flowing across the wing dam cuts a deep pool for fish on the downstream side of the dam. Other structures are placed in the bank to provide overhanging structures for shade and spawning structures (catfish and smallmouth bass).

The Illinois Department of Conservation maintains four fish hatcheries. These hatcheries annually produce over 29 million fish of 15 species. Fish are utilized in lakes and streams to provide initial stockings and, where necessary, supplemental stockings. Some species like muskie, walleye and salmon have limited spawning habitats in Illinois and must be maintained by stocking. Others like large mouth bass, smallmouth bass and bluegill can maintain their populations through natural reproduction.

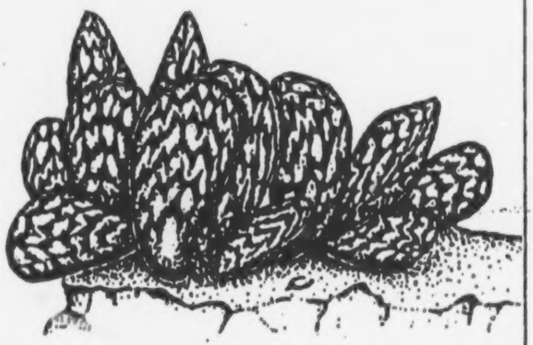
In certain heavily fished water areas the practice of catch and release becomes important. This management technique assures continued survival and proper structure of the fish population. Catch and release is particularly important for predatory species like the largemouth bass, muskie and walleye. Catch and release is not a panacea management tool for aquatic systems. This technique should only be applied when warranted by data.

Enrichment of water from runoff often causes excessive growth of aquatic vegetation. This can damage the fishery by offering too much protection to small fish. If overprotected, the fish may overpopulate and eventually exceed their food supply. When there are too many fish for their food supply, their growth is stunted. Fisheries personnel often treat aquatic vegetation with the goal of keeping it at a level of 20 percent of coverage of the surface of the water area. Aquatic vegetation can not be totally eliminated as it provides cover and food for invertebrates. These invertebrates form the base of the aquatic food chain.

ISSUES The zebra mussel is a critical management issue as it is an unchecked intruder. This exotic species appears at this time to have no diseases or predators in the United States. In urbanized areas, excessive angler demand impacts the opportunity to fish. With demand exceeding supply, restrictions must be placed on the number and size of fish each angler may keep. Illinois' agricultural landscape impacts aquatic habitats. The chemicals used to increase crop production and decrease crop pests run off into lakes and streams. Contaminants that enter the water column eventually enter the fish flesh. Often these contaminants make fish unfit to eat.

Bottom feeders and large predatory gamefish often concentrate large quantities of contaminants in their flesh due to their food habits and longevity.

Zebra Mussels



Urban

DEFINITION A city is an ecosystem. Like all ecosystems, it is a place where living things interact with their environment and with each other. It is, however, a human-maintained and modified environment built by people primarily for their own needs. Unlike most ecosystems, the city requires vast supplies of energy, food and raw materials to support the concentrated human population.

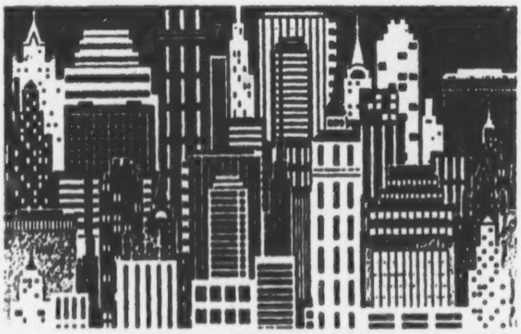
HISTORICAL PERSPECTIVE The urban habitat has changed dramatically throughout history. Early cities were small by today's standards and closely integrated with the surrounding countryside. Some animals from adjacent habitats freely colonized or roamed in the cities.

Major changes took place in city ecosystems as they grew. Large human populations could no longer be supported by nearby resources. Food, fuel and building materials had to be brought in from distant places. Modernized transportation and the growing population, together with poor city planning, led to "urban sprawl" spreading the city environment over vast areas.

ECOLOGICAL IMPORTANCE Urbanization causes major changes in both the biological and physical components of existing ecosystems. Trees, shrubs and other plants are largely removed, and soil is covered by buildings, concrete or asphalt for roads and parking lots. Unpaved soil is packed hard by people walking over it. The water cycle is altered as rain runs rapidly off the impermeable surface and as wetlands are drained and filled for development. Roads criss-cross blocks of habitat, dividing them and restricting free movement of wildlife. Air and water quality are degraded by city wastes.

Temperature patterns change as cities become "heat islands" that are often several degrees warmer than the surrounding countryside. This occurs because city structures absorb and radiate more of the sun's heat than do natural landscapes. Most rainwater runs off and is unable to cool the air by evaporation. The burning of fossil fuels in cities also generates heat.

City Environment



Urbanization destroys or modifies existing natural habitats and creates new ones. Changes in living conditions influence the kinds of plants and animals that can live in an area. The species that establish themselves in city habitats may be quite different from those that existed there previously.

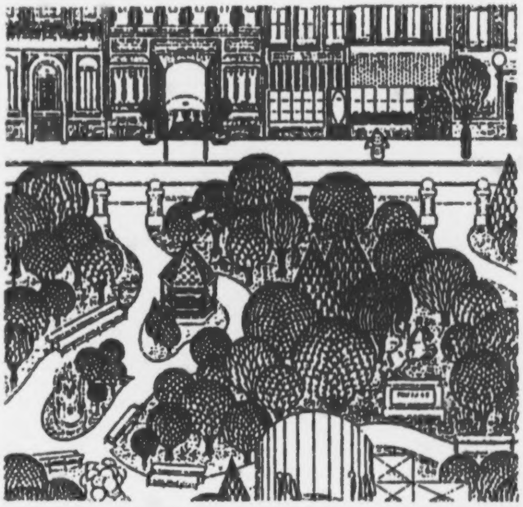
The shift of species is accentuated by accidental introductions and the human penchant for importing exotic plants and animals from distant parts of the world. Introduced trees and other plants, many of which can tolerate urban pollution, soil compaction and lack of water, are often planted instead of native species. These exotic plants can "escape" from their landscaped plantings, thrive and eventually replace native plant species. Thus in urban areas where prairie grasses once grew, you may find ginkgo trees from China. Where an oak forest once thrived, dandelions from Eurasia and the European starling now live.

Animals that survive best in the urban environment are those that can adapt to city food sources and living sites and can tolerate human disturbance. Introduced animals such as starlings, pigeons, rats and cockroaches have adapted so well that many people consider them pests rather than desirable wildlife. Their massive numbers can cause health problems. Many other species can and do coexist peacefully with people in city ecosystems. "Concrete canyons" have become nesting and roosting sites for cliff dwellers such as the peregrine falcon. Chimney swifts trade roosts in hollow trees for city chimneys. Nighthawks nest on flat-topped buildings.

Bats move out of caves and into belfries. Some songbirds move to city parks and residential neighborhoods.

Urban-dwelling wildlife species can create conflict when they occasionally move indoors. Mice and rats frequently take advantage of the shelter and food available in buildings. The same is true, to a lesser extent, of squirrels, raccoons, opossums, lizards, bats and snakes. The fact that some of these wildlife species can carry disease and infection (such as rabies and histoplasmosis) makes them less than desirable additions to the household. They may, however, be beneficial by eating large numbers of insects.

City Park



Even outside, some urban wildlife can cause problems. Raccoons are notorious for their nighttime garbage can raids. Moles frequently dig up lawns as they burrow for earthworms and grubs. Rabbits, squirrels and deer may feed on gardens, flowers and shrubs. Insects are attracted to the lights of houses and in turn can attract insect predators such as bats.

The pigeon is a notorious urban pest and millions live in Chicago alone. Pigeon droppings can carry diseases which affect humans. Pigeons nest on buildings, ledges, nooks, crannies, exposed beams, lattice work and other features similar to their native rocky cliffs. House sparrows nest in holes and crevices provided by certain types of buildings and cause similar problems as pigeons.

Urban areas may have a range of aesthetic values from the blighted and abandoned former industrial site to a well-manicured residential area or an open space preserved as a city park. These areas often have unlimited educational values for the urban inhabitant, either through a formal program offered by a local school, city park district or forest preserve district or the informal educational opportunities gleaned from a walk or run through the area.

ECONOMIC IMPORTANCE Humans need open space. Since the beginning of time we have hunted, fished and gathered from the land and water. Our bodies, minds and spirits have evolved in harmony with the land. Today, however, our complex social organization requires that we attach economic importance to open space. With economic value come management practices and other issues related to land and water use.

In the urban environment, the amount of open space becomes important economically, psychologically and environmentally. The economic value of open space is twofold. First, open space increases the value of the land next to the open space. For this reason, people like to locate their homes near parks, golf courses and undeveloped land on the edge of town. Second, open spaces make businesses more valuable, both because of location and from the perspective of employee benefits. Corporations often locate offices in suburban settings that provide their employees with nearby outdoor recreation.

MANAGEMENT PRACTICES In general, urban conservation programs are designed to control and protect natural resources in or near the city. Erosion control may be necessary on construction projects to stabilize embankments. Culverts and drain pipes may be required to divert the flow of water through less erodible paths. Both methods are designed to protect receiving waters from too much sediment. Similarly, the retention of storm water run-off is necessary to protect rivers and streams from untreated sewage.

Management becomes critical where human and wildlife populations live together and conflicts arise. In many urban areas white-tailed deer and Canada geese populations are a nuisance. Population control by hunting may be warranted but illegal due to city ordinances. Recommendations may be made to permit lethal removal of animals in problem situations. In this fashion, the size of the population is protected from the harsh realities of overpopulation and the conflict with humans is lessened.

Second only to loss of habitat is the threat to native Illinois species from exotic species. Often exotic species are viewed as interesting additions to a flower garden. Once established, these "transplants" often outcompete native species. The problem is compounded due to the lack of the natural enemies that controlled the species in its native habitat. Throughout Illinois, forests are choked with garlic mustard and wetlands are over-run with purple loosestrife. Zebra mussels clog our waterways. Control methods vary from habitat to habitat and species to species. Usually, attempts to eradicate exotic species occur after it has become established. By that time it may be too late.

Urban natural areas must be protected from people. This usually takes the form of regulations to protect native plant and animal communities and restrict use. Many urban land management agencies do not allow any taking of natural resources or introduction of outside species.

Urban areas across the state have urban fisheries management programs. These programs allow local, state and federal agencies to stock urban lakes and lagoons with hatchery raised fish. Seasonal fishing clinics and derbys are then held to provide urban youth with a healthy outdoor experience.

ISSUES Not surprisingly, conflicts occur about the best management practices for urban natural resources. On almost any day newspapers from major cities throughout the state carry articles on human-wildlife conflicts. The causes of conflicts vary. Development versus preservation, hunting versus animal rights, private use of land and how it affects public land, or building artificial wetlands to replace destroyed natural wetlands are a few examples. Addressing these complex issues is one responsibility of natural resource managers. The issues and resolutions touch the lives of every citizen of Illinois, whether urban or rural residents.

Projects and Activities:

1. Discuss the role of fire in management of forest and grassland communities. How does the class feel about natural fires in various areas—wilderness, national parks, forest land, grassland, habitat managed for an endangered species, suburban area near a nature preserve? Do their attitudes differ on the use of prescribed fire as a management tool for the same areas? What guidelines would the class set for the length of time a fire would be allowed to burn without human intervention? How much area would they permit to be burned?
2. On a county plat map (available at county court house), locate where all state, federal and industry land is located.
3. Using the information contained in the figure 2 (Wetland Characteristics), create a dichotomous key.
4. Interview or invite a representative of a city organization involved with promoting and developing urban habitats to speak to your class. Review projects which have been completed and are ongoing. Determine how the class can assist with the effort.
5. Design and administer a community survey about attitudes on forest management practices (group selection, clear cutting). Include consumptive and non-consumptive issues. Interview a variety of people including family and community members. Present findings in report and oral format.
6. At the Recorder of Deeds office in the county courthouse, find out how much land in your county is owned by a forest product industry and how much is state or federally owned.
7. Review a topographic map of a large river. Identify oxbow lakes, meanders, sandbars (islands), dikes, levees, dams and other humanmade and natural features.
8. Have students role-play managing a tree farm and consider the economic factors that influence management decisions by participating in the Project Learning Tree activity "Forest for the Trees" (see "A Closer Look").

Evaluation:

1. In role playing members of Congress, the class has the authority to allow use of wilderness areas when in the best interest of the nation. Under what situations would they allow the development of a designated wilderness area? What criteria would they use and would the criteria differ for the type of use proposed? Types of uses that should be considered include mining, timber harvest, oil drilling and development.
2. Prepare a chart that shows a nutrient cycle in one of the five common Illinois habitats.
3. Identity a number of ways in which urbanization can improve habitats for wildlife. Also identify how it can harm habitats.
4. Identify methods and develop sampling techniques to assess the health of an urban habitat (pH level of water to determine acid pollution, glass slide to collect particulate air pollution, noise evaluation, white sock to collect automobile emissions, soot and dead spots on leaves, dog wastes). Conduct an evaluation at various locations in the community. Plot and record results. Develop statement of conclusion on results.
5. After individual study of a specific habitat, ask students to prepare a number of "trivia" questions using the reference material they have located. Conduct your own research and add your questions to those provided by the students. Write each question on an index card with the answer on the reverse. Divide students in teams and have them choose a "habitat" name for their team. If a team correctly answers a question, if should receive one point. If its answer is incorrect, proceed to the next team until one answers correctly or all teams have had an opportunity to answer the question. Play should proceed until one team receives the pre-set winning score (10 points). If multiple habitats are studied, repeat the game or shuffle all the "habitat" cards together.
6. Using the definitions in the vocabulary section, have students graphically represent the differences between the various types of even-aged management (clearcut, shelterwood cut, seed tree cut) and uneven-aged management (group selection cut, individual tree selection).

Extensions:

1. Call the U.S. Environmental Protection Agency Wetland Protection Hotline at 800/832-7828 to learn more about wetland functions, values and protection. They will provide information and refer you to experts to answer specific wetland questions. The hotline office is open weekdays (except federal holidays) from 9 a.m. to 5:30 p.m. EST.

2. Visit a variety of forests, including some classified as old growth and second growth. Visit forests managed under various management techniques, including clear cutting, group selection and fire. Compare and contrast the types of vegetation and wildlife found in each.

3. Using a soil survey map (available from your county Soil and Water Conservation Service office), compare soil types of forest, prairie and wetland habitats. Prepare a chart showing characteristics of soils common to each.

4. Obtain copies of maps of your area that depict wetland communities. After studying the maps and learning how to identity the various wetland communities, verify the information with field trips to representative communities.

5. John Deere invented the self-cleaning plow in Grand DeTour, Illinois. Research how the plow changed the landscape of Illinois.

6. Conduct an inventory of the design features of an urban building that would make it attractive or unsuitable for a common urban resident such as a rock dove, house sparrow, starling or Norway rat. Design a building to deter these species or attract a desired species, such as the peregrine falcon.

7. Learn about the non-profit organization American Rivers (801 Pennsylvania Ave. SE #303, Washington, D.C. 20003; 202/547-6900) and its efforts to add rivers to the Wild and Scenic River System.

8. Write the U.S. Geological Survey (Map Distribution, Federal Center, Box 25286, Denver, CO 80225; 303/236-7477) for maps and brochures on the Wabash River basin. The information will contain a discussion on the river's early exploration; its headwaters, mouth and major tributaries; a description of its course, length, width, depth and rate of flow; the river's dams, reservoirs and canals; its geologic setting and drainage area; water quality and use; and major cities along its route.

9. The U.S. Geologic Survey (Map Distribution, Federal Center, Box 25286, Denver CO 80225; 303/236-7477) offers State Hydrologic Unit Maps at a cost from $1.75 to $5. These maps are used primarily for professionals responsible for managing natural resources and recreation areas.

10. Twelve additional activities on wetlands, a poster and set of 20 wetland slides are available from the Illinois Natural History Survey in Wetland Wonders-Instructional materials for the study of Midwestern wetlands (M.R. Jeffords, A.S. Hodgins and S.P. Havera, Special Publication 14, September 1992; Distribution Center, 607 East Peabody Drive, Champaign, IL 61820, 217/333-6880).

11. Learn about biodiversity through activities contained in a learning module entitled Biodiversity. (M.R. Jeffords, Illinois Natural History Special Publication 13, 1992; Distribution Center, 607 East Peabody Drive, Champaign, IL 61820, 217/333-6880). Biodiversity is the large variety of living things on Earth and contributes in some way to a healthy environment.

12. The Heartland Rivers Council has developed a curriculum unit entitled The Illinois River System. To obtain a copy contact the Illinois Department of Conservation Education Program (address on cover sheet of this education kit) or the Council at 5823 Forest Park Drive, Peoria, Illinois, 61614.

Vocabulary: habitat, old growth forest, second growth forest, even-aged management, uneven-aged management, clearcut, shelterwood cut, seed tree cut, group selection cut, individual tree selection, prescribed fire, perennial stream, intermittent stream, fen, marsh, bog, hydrophytic, extirpated, forb, mesic, fossorial, humus, tributaries, floodplain, watershed (drainage basin), meander, chute, alluvium, turgor

42

CONSERVATION EDUCATION TODAY & TOMORROW

Teacher's Guide

SUGGESTED GRADE LEVELS: 7-10
SUBJECTS: Social Science, Science, Language Arts
SKILLS: data collection, writing, comparison, critical thinking, group process, decision making, problem solving, interpretation
CORRELATION TO STATE GOALS FOR LEARNING:
Social Science (5), Science (2), Language Arts (1,2,3,4,6)

Taking Action

Objective: Students will apply knowledge gained about the natural resources and participate in some action to improve or support resources.

Background: Concern for environmental issues and an appreciation for the natural resources is growing in the United States. Outdoor photography and viewing of wildlife are enjoyed by over three-quarters of Americans, according to a survey published by the U.S. Fish and Wildlife Service.

You really are concerned for the Earth, but what can you as an individual do to help? Get involved! Use the information gained about natural resources toward activities that educate people about the environment in your community, the state and the world.

There are many organizations that work to preserve and protect habitats and that are interested in cleaning up the environment. Contact the local, state or national office of groups such as the National Wildlife Federation, The Nature Conservancy, Audubon Society, Sierra Club, Pheasants Forever, Ducks Unlimited, Ruffed Grouse Society or Global ReLeaf to learn about their programs to better the environment.

Volunteer to help with projects they are conducting in your area. If you can not find a group that works for your cause, talk to others in your neighborhood or school that share your interests and form your own club.

Several environmental and sporting organizations reward individuals and groups for significant accomplishments. Contact organizations to learn more about awards programs. Apply for environmental awards for the new and *innovative* projects you have undertaken.

There are five major steps to an action project. First, you must identify and clearly state the problem and type of outcome desired. At this stage try to brainstorm with the group. Brainstorming is the collection of ideas, good and bad. At this stage you do not discuss any of the ideas or make judgments. You will find that as an idea is presented, others will build on it and develop a stronger idea. Ask one person to record all the ideas to provide a record that can be used to define and select a project.

The second step involves a thorough review of the problem. Study the history and determine the source of the problem. Interview the major players, and identify the effects these problem had on them.

The third step is to develop an action plan. Such a plan will be based on the information collected during the research phase. You should prepare a chart that graphically identifies the costs and benefits of various solutions and the values and principles involved. Decide what types of human and financial resources are needed and the amount of time necessary to complete your plan. Also consider whose permission you may need to undertake the project. Identify other groups that share your interest and may want to join the project.

Your plan may recommend an action designed to persuade or motivate people to change habits or an idea. Some people develop plans that address the consumer aspect such as boycotting or another type of economic action to effect desired results. Other action approaches may include using political or legal systems and developing a "hands-on" approach to the project, such as where participants take responsibility for carrying out a habitat management plan. Each type of action may be used individually or in combination to achieve the desired goal.

Implementation of the plan is the fourth level of an action project. Prepare for an interview by determining your questions before the interview. Practice with your friends or family and change any questions that are unclear or weak. Anticipate potential answers and prepare appropriate follow-up questions. If your plan includes letters and statements, they should be typewritten, dated and addressed correctly. If personal conversations or telephone calls are made, keep records of the topics discussed, who attended, the date and the nature of any decisions made. Maintain a *correspondence* file and notes of verbal conversations for your records.

If your plan requires that you work with the media, establish yourself and your organization as one that provides accurate, timely and *concise* information. Media representatives seek stories that are newsworthy, that are prepared for a general audience and that allow sufficient time for further research by their staff.

The final step is to evaluate the effectiveness of the action. Your review should consider the number of people involved, the type of planning done, the type and amount of action taken and whether the action addressed the problem. This information will help determine if the plan should be modified, if additional action is needed or whether the plan met the desired outcome.

Projects and Activities:

1. Write for information about a topic you are interested in. Form a school or class conservation club. Disseminate the information to other students and local decision makers.
2. Help with a clean-up project or assist with fund-raising for an environmentally oriented project; volunteer to do a radio public service announcement for the group.
3. Create an outdoor education classroom: plant native trees, shrubs, grasses and flowers. Construct and place nest boxes, bird feeders or brush piles.
4. Clean up public areas, parks, lakes and streams, vacant lots or wetlands.

Evaluation:

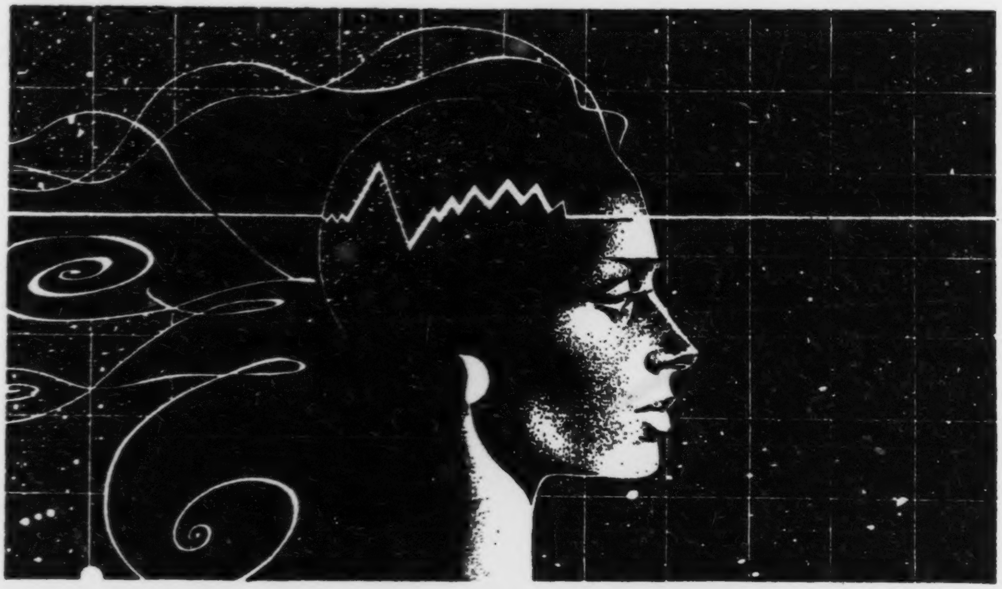
1. Have students write up results of their action project; share papers with newspapers, local decision makers and others in the school.
2. Compare original land documents and survey maps (available in County Records Office) to current maps of the community; determine and map out land-use changes (habitats). Have students interpret how land-use changes have affected local plant and animal populations.

Extensions:

1. In small groups, videotape a role-playing exercise or mock debate. Input a "Pause Here" just before the outcome decision. Allow any group viewing the video to conduct their own discussion, forming their own decisions. Then continue the tape to the end and compare outcomes.
2. Learn about environmental policies and legislation affecting natural resources. Write to your newspaper or legislator in support of your position.

Vocabulary: innovative, consumer, implementation, correspondence, concise

Brainstorming



Construction of an Aquarium or Terrarium

See related Lesson Plans "What Are Natural Resources" (page 1) and "What Is An Ecosystem?" (page 3).

The following is a series of experiments that may be used to show the independent parts of an ecosystem. Used sequentially, the experiments can demonstrate how an ecosystem interacts with its parts. Students should document experiments on paper, noting procedures, observations and results. From these notes, students should write a descriptive paper on the experiment, giving a final evaluation.

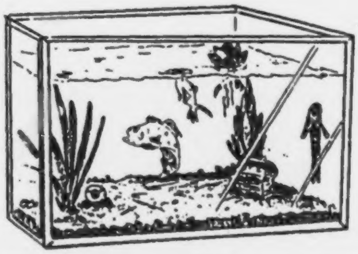
Starting An Aquarium Or Terrarium

Materials Needed:

AQUARIUM	TERRARIUM
10 gallon tank with hood	10 gallon tank
tap water	small electric aerator
dechlorinator	plastic tubing
air stones	sand
undergravel filter	gravel
gravel	rocks

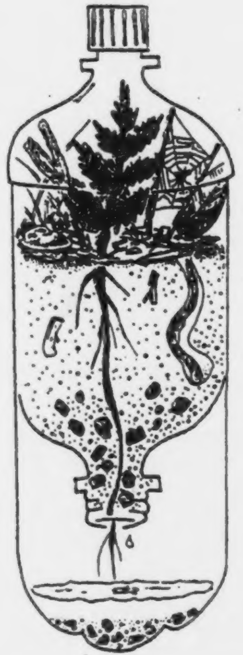
As a project to demonstrate recycling, an aquarium or terrarium may be constructed from plastic soda bottles (see Ingram, Mrill. *Bottle Biology: An Idea Book for Exploring the World Through Soda Bottles and Other Recyclable Materials.* [Kendall/Hunt Publishing Co.,] 1993).

aquarium



1. Identify the physical, nonliving natural resources in the tank. What are their origins? Are they renewable or nonrenewable?
2. How do the solids, liquids and gases interact? What other substances do they form? Are they renewable or nonrenewable?
3. Demonstrate the water cycle by covering the aquarium or terrarium with cellophane and applying a light source. Discuss condensation, evaporation and precipitation and the role they play in the ecosystem.
4. A host of small organisms are responsible for decomposition. Does decomposition occur in your system? Why or why not? If so, at what rate do materials decompose? What could be added to the system to initiate or speed up decomposition?

terrarium



Add Living Organisms To An Aquarium or Terrarium

Establishing an aquarium or terrarium is fun but caution must be exercised in obtaining materials for the system.

Consider acquiring the organisms needed for the system from a plant nursery or aquarium shop. Never collect materials from a natural system unless you have permission from the person or organization that owns the land. Minimize the number of organisms collected. You may not collect anything from a state or national park. Never collect rare or endangered species. Never collect a plant if it's the only one growing in a particular area. Return all organisms to the spot they were found as soon as the observations are complete.

AQUARIUM	TERRARIUM
leaves, twigs, log	leaves, twigs, log
rooted or floating aquatic plants	mosses, ferns, grass
snails, mussels, worms	insects, toad, spiders
fish—suckers, minnows, small bass	carnivorous plants

Observe the predator/prey interactions and other life processes that take place. Ask your students the following questions.

1. Where do the animals get food, shelter and oxygen?
2. What niche or job does each animal have in the ecosystem?
3. How is this microcosm like our ecosystem?

Manipulating The Ecosystem

Recognizing that in nature ecosystems do not consist of independent parts, what will occur in the aquarium or terrarium if a living or nonliving component from the microcosm is removed? What will occur if a substance is introduced or occurs in quantities greater than normal (salt, water)? Observe and record the effect on the rest of the biotic community. Ask your students the following questions.

1. How can we restore the balance?
2. What management methods should we use?
3. Are there alternatives to management? If so, what are they?

Extensions:

1. Challenge others to a "rot race" to see who can set up a terrarium with the fastest decomposition.
2. Examine and identify the microorganisms that occur in the aquarium or terrarium. What purpose does each serve?
3. Collect soil from a number of locations in your community. Allow the soils to dry several days. Place each soil in a separate terrarium. Add water and mix vigorously. Watch as the soil layers separate. Identify the soil layers. Conduct experiments to determine which soils are best for plant growth.
4. What is the simplest, balanced system that can be created? What is the most complex, balanced system that can be created? How long can each be maintained?

Censuses and Estimates

See related Lesson Plans "Why Manage Natural Resources?" (page 5), "Species Management" (page 15) and "Habitat Management" (page 21).

A **census** is a count of all the individuals in a population.

Counting all the students in your school is a **quantitative** census.

Counting all the students by grade level in your school is a **qualitative** census.

An **estimate** is a count of a portion of the population.

Counting all the students in one classroom and multiplying that number by the number of classrooms provides an estimate of the school population.

Counting the number of people walking down the hall at a specific time and comparing it to the same information collected each year would provide an index of the population growth or loss.

Complete this chart:

	ESTIMATE				CENSUS
	Room #	Room#	Room#	Room#	
# freshmen					
# sophomores					
# juniors					
# seniors					
TOTAL					
x # classrooms					
TOTAL					

Census vs Estimate

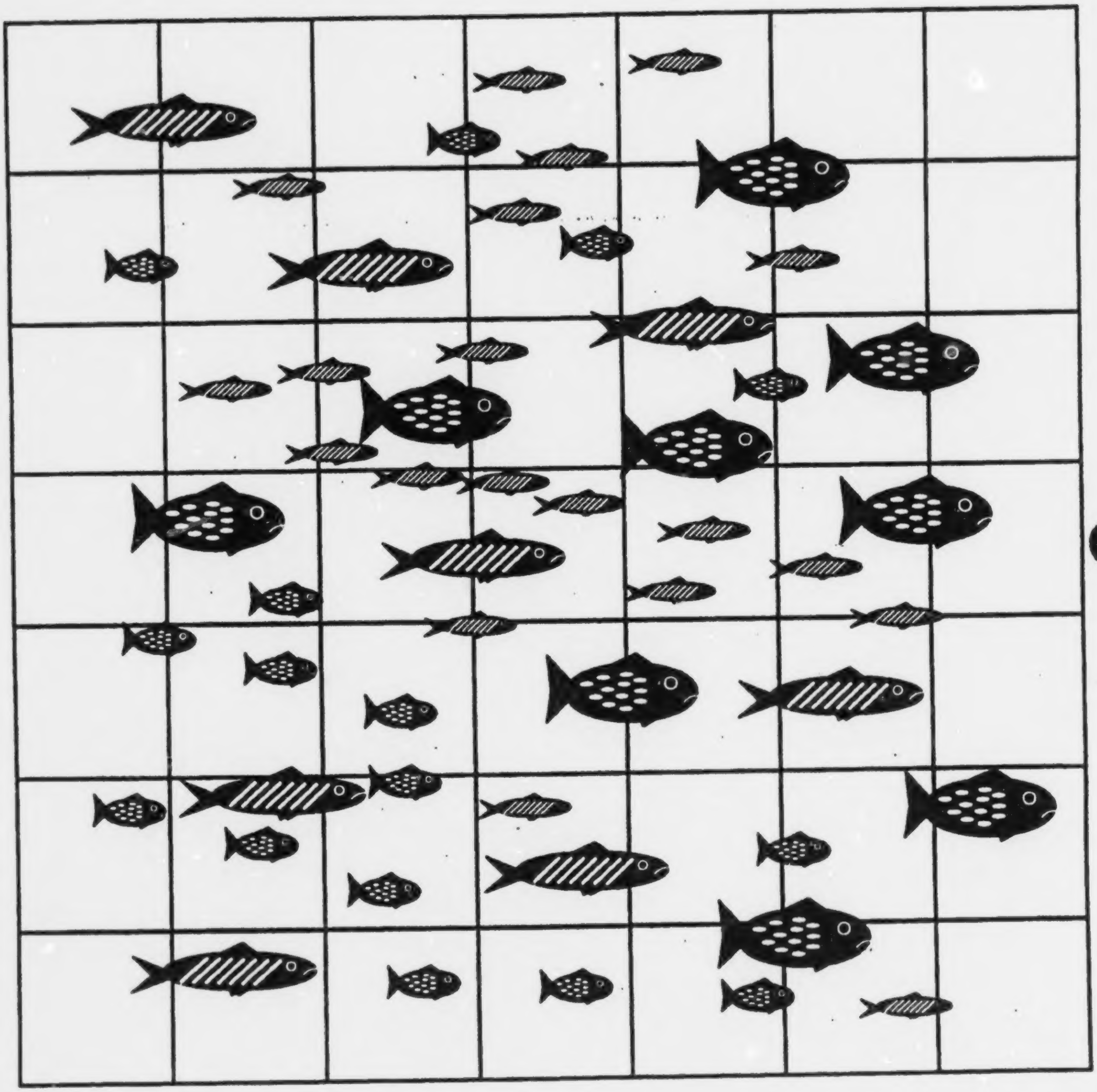
Which is more time consuming?

Which requires more personnel?

Which is least expensive?

Which is most accurate?

How many estimates were necessary to be within 10% of the census?________ 5%________ 1%________



CONSERVATION EDUCATION
TODAY & TOMORROW

Resolving Problems

See related Lesson Plans "Values and Principles" (page 9), "Conflicts, Resolution and Planning" (page 11).

Instructions: Working in groups, review the problem-based learning scenarios below. How would you address each problem? What additional information would you need to make a decision? What processes do you use to reach consensus? Do other groups come to the same conclusions? Why or why not?

#1. You and your brother have hunted pheasants together for 10 years. Since then, farming policies and practices have nearly destroyed the pheasant habitat. You have just inherited your father's 100 acre farm, farming equipment and farm house. Aside from cost of living, your only expense is $5,000/year in property taxes. Your brother has agreed to let you live in the farm house if you split the farm production profits with him 50/50. To continue farming at current production, however, it will cost you $10,000 a year at today's market prices. You have projected a $250/acre profit in corn and soybean sales.

Since Illinois tallgrass prairies are virtually extinct, a newly formed organization interested in establishing prairies through the state has approached you with a land management proposal. They will underwrite a percentage of your property taxes if you and your brother will take 50 acres out of production. They have also offered to pay you $5,000 a year if you will restore the tallgrass prairie and provide stewardship services to the "unproductive" ground.

How will you convince your brother that it is in his best interest to accept the offer and make only half as much profit from the land while retaining full rights of ownership?

A few years later the state restoration project is deemed so successful that they've offered to buy the farm at $1000/acre and dedicate it for public use. They have asked you to serve as the resident biologist responsible for managing the site. Your brother has agreed to the sale, in return for his share of the profits. How will you go about managing the site? Can you manage for both consumptive and nonconsumptive uses?

#2. Your grandfather purchased a wetland area in the early 1900s. Family members spent one summer building a cabin that was used by the extended family for many summer vacations. In the fall, the cabin was used during duck hunting season. Your generation continues to use the cabin but now finds it is in severe disrepair. You have found that extensive permitting will be required due to new state and federal regulations regarding construction in floodplains. In fact, you may not be able to rebuild on the site. How would your family address the problem? How much are you willing to spend to rebuild the cabin and continue to use the site for vacations and hunting?

#3. Your neighbors are complaining about the high cost of fresh vegetables and their utility bill. You suggest that they read the following passage in Aldo Leopold's Sand County Almanac to further clarify and understand the issue.

> There are two spiritual dangers to not owning a farm. One is the danger of supposing that breakfast comes from the grocery, and the other that heat comes from the furnace....

How can you further educate your neighbors about how the weather impacts natural resources and the subsequent affect it has on supply, and therefore, costs?

CONSERVATION EDUCATION TODAY & TOMORROW

American Conservationists

See related Lesson Plans "Values and Principles" (page 9), "Taking Action" (page35) and the "Take Action" poster (front pocket).

Students should research the work and philosophies of American conservationists, naturalists and environmentalists. Have students select one person on which to prepare a one-page paper, including information on his/her life, the people he/she influenced and significant accomplishments. They should include a brief paragraph defining the values and principles held by the person researched and why they agree or disagree. Working in teams, edit, proofread and illustrate each paper. As a class, compile the papers in a book and design a cover. Share the book with schools in your community.

Activities:

Have each student act the part of a person they have researched. They then should develop a research grant that proposes continuing their work. Assemble a panel of experts to review the proposals. Do the decisions of the panel vary with potential amounts ($1,000, $100,000 or $1,000,000)?

Add these people to the environmental timeline. Did their work have an impact on the environmental actions occurring at the time? Did actions follow their recommendations by several years? Did their work affect local, state or national policies? After becoming knowledgeable about the work of these people, identify any programs or actions they originated that continue today.

Partial Listing:
Louis Agassiz (1807-1873)
Roy Chapman Andrews (1884-1960)
John James Audubon (1785-1851)
Florence Merriam Bailey (1863-1948)
Liberty Hyde Bailey (1858-1954)
Spencer F. Baird (1823-1887)
Charles William Beebe (1877-1962)
David Brower (1912-)
John Burroughs (1837-1921)
Rachel Carson (1907-1964)
George Washington Carver (1864-1943)
George Catlin (1796-1872)
Frank Chapman (1864-1945)
Jane Colden (1724-1766)
Barry Commoner (1917-)
Anna Botsford Comstock (1854-1930)
Jay N. "Ding" Darling (1876-1962)
Raymond Ditmars (1876-1942)
Marjory Stoneman Douglas (1890-)
Paul Ehrlich (1932-)
Charles W. Eliot (1834-1926)
Ralph Waldo Emerson (1803-1882)
Stephen Forbes (1844-1930)
Horace Greeley (1811-1872)
William T. Hornaday (1854-1937)
Thomas Jefferson (1743-1826)
Aldo Leopold (1886-1948)
Graceanna Lewis (1821-1912)
George Perkins Marsh (1801-1882)
Robert Marshall (1901-1939)
Clinton Hart Merriam (1855-1942)
Ann Haven Morgan (1882-1966)
John Muir (1838-1914)
Margaret Morse Nice (1883-1974)
Frederick Law Olmsted (1822-1903)
Edith Patch (1876-1954)
Gifford Pinchot (1865-1946)
John Wesley Powell (1834-1902)
Franklin D. Roosevelt (1882-1945)
Theodore Roosevelt (1858-1919)
Albert Schweitzer (1875-1965)
Henry David Thoreau (1817-1862)
Stewart L. Udall (1920-)
Izaak Walton (1593-1683)
Alexander Wilson (1766-1813)

Values and Principles

See related Lesson Plan "Values and Principles" (page 9).

A value is the comparative worth placed on something. The basic types of values, with a definition and an example of a natural resource value follows.

political - the role or position of a governmental agency
Annual regulations limit the number of deer that may be harvested.

economic - the use for food, clothing, shelter and other benefits
Deer hunters contribute to the economy through purchase of licenses, guns, ammunition, gasoline, food and lodging.

religious - faith
They honored the deer for its grace and speed.

ecological - maintenance of a natural ecosystem
Lacking natural predators, white-tailed deer populations increase.

scientific - to help understand the environment
Data collected from check stations shows that the average white-tailed deer harvested in Illinois is 1.7 years old.

cultural - societal customs and beliefs
Native Americans used all parts of the deer, including meat, hide, sinew, brains and urine.

educational - to help understand species and the role people play
Safe and legal hunting required educated participants.

aesthetic - as a source of beauty and inspiration
I marvel at the sight of a white-tailed deer.

social - shared human emotions and status
My friends and I agree with the proposed increase in hunting season length.

recreational - providing leisure activities
I look forward to fall and trips to the woods to scout for deer sign.

egocentric - focus on human benefit of resource
My dream is to bag a 12-point buck with a bow and arrow

health - positive human condition
Being physically fit makes hunting safer and more enjoyable.

ethical/moral - responsibilities and standards
Everyone is responsible for reporting poachers.

historical - connection to past
The white-tailed deer is present in greater numbers today than at any other time in history.

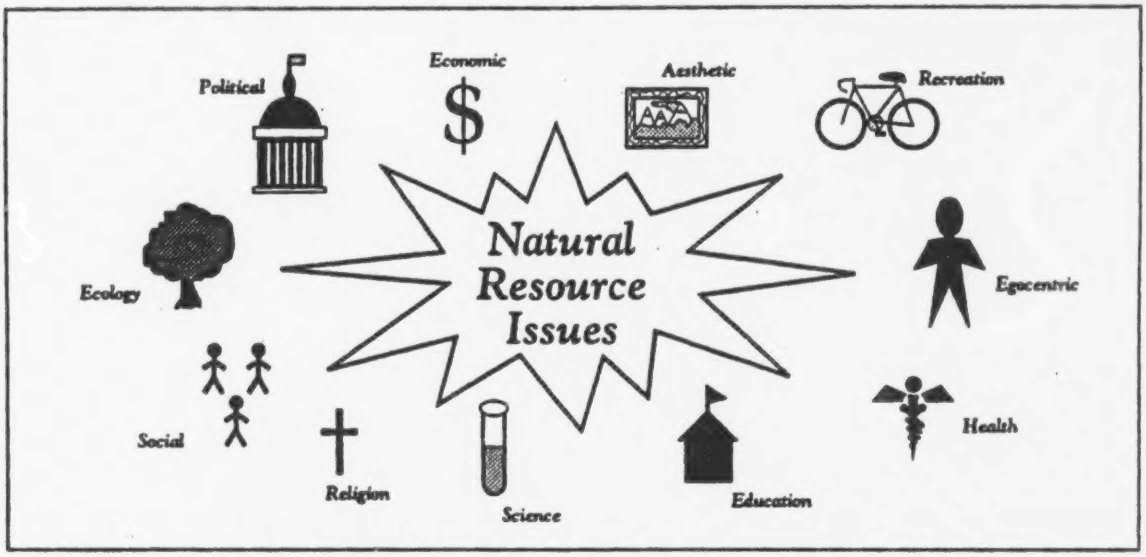
Extensions:

1. Select a natural resource topic and develop a statement that fits each type of value.
2. Review newspaper or magazine articles and identify value statements. Which type of value appears most often? Least often? Which types of value statements appear within quotes?

Answers

A — 1
B — 2
C — 6
D — 4
E — 7
F — 3
G — 14
H — 8
I — 11
J — 5
K — 12
L — 2
M — 9
N — 10

Values and Principles



Review the value statements below that pertain to white-tailed deer populations in Illinois. Identify the value that best describes each statement.

A. political
B. ethical/moral
C. cultural
D. ecological
E. educational
F. religious
G. historical
H. aesthetic
I. egocentric
J. scientific
K. health
L. economic
M. social
N. recreational

____ 1. Annual regulations limit the number of deer that may be harvested.

____ 2. Deer hunters contribute to the economy through purchase of licenses, guns, ammunition, gasoline, food and lodging.

____ 3. They honored the deer for its grace and speed.

____ 4. Lacking natural predators, white-tailed deer populations increase.

____ 5. Data collected from check stations shows that the average white-tailed deer havested in Illinois is 1.7 years old.

____ 6. Native Americans used all parts of the deer, including meat, hide, sinew, brains and urine.

____ 7. Safe and legal hunting required educated participants.

____ 8. I marvel at the sight of a white-tailed deer.

____ 9. My friends and I agree with the proposed increase in hunting season length.

____ 10. I look forward to fall and trips to the woods to scout for deer sign.

____ 11. My dream is to bag a 12-point buck with a bow and arrow

____ 12. Being physically fit makes hunting safer and more enjoyable.

____ 13. Everyone is responsible for reporting poachers.

____ 14. The white-tailed deer is present in greater numbers today than at any other time in history.

CONSERVATION EDUCATION
TODAY & TOMORROW

Resource Conservation
Activity Page

Environmental Assessment

See related Lesson Plans "Conflicts, Resolution and Planning" (page 11), "Taking Action" (page 35) and the "Take Action" poster (front pocket).

Working in a team, students should identify a local project that may impact the environment. Projects for consideration may include road construction, bridge replacement or conversion of habitat for residential, business or agricultural purposes. Details of the proposed project should be obtained from a variety of sources, including zoning or planning agencies, natural resource agencies, landowner, developer and the media. A field trip to the site may be required. As reference for future discussions, photographs or a sketch of the site should be made.

After collecting all available data, have students complete the environmental assessment statement checklist (attached). This form approximates those used by state and federal agencies in assessing environmental impacts of proposed projects.

All questions must be answered using the four levels of impact: B=beneficial, N=neutral, A=adverse, n/a= not applicable. If an item is marked "not applicable" an explanation should be made on a separate piece of paper. Where possible, items should be quantified, such as the number of trees removed, length of stream modification or number of houses relocated.

After completing the environmental assessment statement checklist the team should then discuss the project and determine if the project will or will not have significant environmental impacts. A discussion of project modifications should take place to determine what changes could be made to lessen the environmental impacts. A group presentation to the class should be made to discuss the project and the reasons for the team's assessment. The team should be prepared for challenges to any of their assessments.

ENVIRONMENTAL ASSESSMENT STATEMENT CHECKLIST

Project Name: ______________________________

Project Location: ______________________________

Team Members: ______________________________

KEY: B=beneficial, N=neutral, A=adverse, n/a= not applicable

	B	N	A	N/A
SOCIO-ECONOMIC FACTORS				
land-use change consistent with local plans	___	___	___	___
economic impacts	___	___	___	___
impacts on neighborhoods/community cohesion	___	___	___	___
relocation of residences/businesses	___	___	___	___
impacts on churches/schools	___	___	___	___
potential for controversy ○ YES ○ NO				
RESOURCE FACTORS - impacts to or the presence of:				
publicly owned parks	___	___	___	___
recreation areas	___	___	___	___
wildlife areas	___	___	___	___
waterfowl refuges	___	___	___	___
historical sites	___	___	___	___
archaeological resources	___	___	___	___
wetlands	___	___	___	___
streams (modification)	___	___	___	___
wild and scenic rivers	___	___	___	___
floodplains	___	___	___	___
threatened and endangered species	___	___	___	___
farmland conversion	___	___	___	___
agricultural operations	___	___	___	___
hazardous materials wastes	___	___	___	___
energy use impacts	___	___	___	___
construction impacts	___	___	___	___
tree removal	___	___	___	___
PHYSICAL ENVIRONMENT				
water quality	___	___	___	___
noise	___	___	___	___
attainment of air quality standards	___	___	___	___
OTHER FACTORS				
visual impacts	___	___	___	___
impacts on utilities and railroads	___	___	___	___
pedestrian/bicyclist considerations	___	___	___	___
detours; temporary closures of roads/ramps	___	___	___	___
changes in access control	___	___	___	___

OUR GROUP FINDS THAT THIS PROJECT WILL:

○ HAVE NO SIGNIFICANT ENVIRONMENTAL IMPACTS
○ HAVE SIGNIFICANT ENVIRONMENTAL IMPACTS

SIGNED: (all team members)

Turkey Trouble

See related Lesson Plans "Species Management" (page 15) and "Habitat Management" (page 21) and "Design a Resource Management Area" (front pocket).

Objective: Students will be able to define and give examples of exponential and linear growth rates in wildlife populations and describe factors that affect and limit growth of wildlife populations.

Background: Growth rates can be characterized by two different growth curves: linear and exponential. Linear growth occurs at a constant rate. Many increases or decreases occur at linear rates. An example of this would be having your salary increase by $1,000.00 per year. Exponential growth occurs at an increasing rate through time. An example would be having your salary increase (or decrease) at a rate of 5 percent per year.

Since all populations have the reproductive potential to increase at an exponential rate, it is difficult to comprehend the gravity of problems associated with population growth. Population is limited by many factors, including availability and quality of water, food, shelter and territory, as well as natural and human-made changes in habitat.

As an example, the eastern wild turkey was abundant in Illinois into the late 1800s but was seldom reported after 1900. In 1959, the Illinois Department of Conservation obtained 64 wild-trapped turkeys from Mississippi, Arkansas and West Virginia and released them in five locations in the Shawnee National Forest. This activity will provide students with the opportunity to compute the possible growth of the turkey population during its first five years after the planting. As background, students should recognize that, in reality, these turkeys will be affected by many natural and human-caused limiting factors. For example, growth of bird populations is affected by factors such as the availability of food, water, shelter and space; disease; predation; climatic conditions; as well as broken or infertile eggs.

The major purpose of this activity is for students to acquire a working knowledge of some factors affecting wildlife populations.

Materials: paper, graph paper, pencils

Procedure:

Task 1

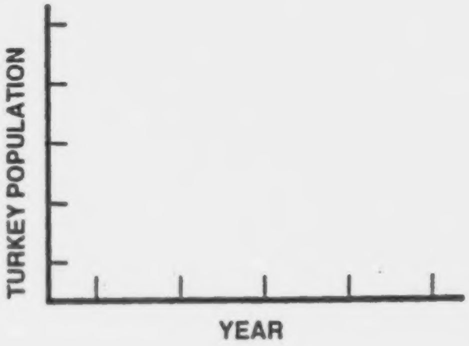
Compute the size of the population of the eastern wild turkeys in Illinois for five years, using the following assumptions. Complete the data table (see Appendix A).

Assumptions:

1. None of the turkeys left the general area during the five years.
2. There was no disease or shortage of habitat that limited the population.
3. An equal number of males and females were present in each hatch.
4. All sexually mature females successfully hatched a clutch of ten eggs each year.
5. Turkeys start to reproduce their second year of life.
6. All turkeys died during the winter after their fifth year of life (after hatching their fourth clutch).
7. All turkeys introduced were two years old and in their first year of sexually maturity.
8. An equal number of males and females were present in the original 64 turkeys released.

Task 2

Plot the population against the five years on a graph as indicated by the diagram below. Use a full sheet of paper for the graph, making it as large as the paper will allow.



Task 3

Compute the size of the population of eastern wild turkeys in Illinois using a linear growth module for five years based on the following assumptions. Complete the data table (see Appendix B).

Assumptions:

1. 320 offspring were produced by the turkey population each year.
2. None of the turkeys left the area.
3. There was no disease or shortage of habitat that limited the population.

Task 4

Plot the data from Task 3 on the same graph used in Task 2.

Task 5

Assign or discuss the following questions as related to the previous tasks:

1. In the examples given, which growth patters appear to be increasing at a faster rate? Why?
2. The estimate of the true population of the eastern wild turkey by the Illinois Department of Conservation at the end of the five years was ____. How can we account for the difference? Were any of the original assumptions incorrect? Which ones?
3. All populations have the potential to increase at an exponential rate. What factors limit this potential?

Evaluation

1. On an island, a rabbit population is doubling every year for six years. If you started with one pair (one male and one female), what would the population number after six years? This is an example of what kind of population growth?
2. A population of mountain lions is increasing by two members per year. If you started with two animals, what would the population size be after six years? This is an example of what kind of population growth?
3. List three natural limiting factors that could affect the growth of a rabbit population.

Extensions

1. Get background information and data regarding a similar situation and compare population growth rates.
2. This activity does not address the consequences—potentially beneficial, harmful, or with no appreciable effect—of introducing or reintroducing species to an area. Discuss the consequences to other wildlife and the environment of introducing non-native species.

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Adapted from the Project WILD Activity "Turkey Trouble"

TEACHER COPY

EXPONENTIAL GROWTH DATA TABLE

	YEAR	1	2	3	4	5	6
1.	Beginning population	64	384	704	2624	6144	18,880
2.	− five year olds	0	0	0	0	64	0
3.	− last year's hatch (not yet breeding)	0	320	320	1920	3520	12,800
4.	= Breeding population	64	64	384	704	2560	6080
5.	Breeding pairs (#4/2)	32	32	192	352	1280	3040
6.	Offspring (#5 x 10 eggs/clutch)	320	320	1920	3520	12,800	30400
	+ breeding population (#4)	64	64	384	704	2560	6080
	+ last year's hatch (#3)	0	320	320	1920	3520	12,800
7.	= Total population	384	704	2624	6144	18,880	49,280

LINEAR GROWTH DATA TABLE

YEAR	1	2	3	4	5	6
Population	64	384	704	1024	1344	1664
+increase	320	320	320	320	320	320
= total population	384	704	1024	1344	1664	1984

STUDENT COPY

EXPONENTIAL GROWTH DATA TABLE

YEAR	1	2	3	4	5	6
1. Beginning population	64	384	704			
2. – five year olds	0	0	0	0	64	0
3. – last year's hatch (not yet breeding)	0	320	320			
4. = Breeding population	64	64	384			
5. Breeding pairs (#4/2)	32	32				
6. Offspring (#5 x 10 eggs/clutch)	320	320				
+ breeding population (#4)	64	64				
+ last year's hatch (#3)	0	320				
7. = Total population	384	704				

LINEAR GROWTH DATA TABLE

YEAR	1	2	3	4	5	6
Population	64	384				
+increase	320	320				
= total population	384	704	1024			

A Prairie Web of Life

See related Lesson Plans "Species Management" (page 15), "Habitat Management" (page 21) and "Design a Resource Management Area" (front pocket).

1. Working in pairs or teams, students should brainstorm a list of components they feel are necessary to support a healthy prairie ecosystem. As a class, compare the lists prepared by each group. Identify the living and nonliving components of the ecosystem.

2. Make a cumulative list of each group's plants and animals. Examples include:

Plants	**Animals**
big bluestem	monarch butterfly
Indian grass	ground squirrel
prairie sunflower	harrier (marsh hawk)
prairie dock	prairie chicken
black-eyed susan	white-tailed deer
goldenrod	coyote

3. Have each pair or team choose a prairie inhabitant to research. Those selecting a plant group should answer the following questions:

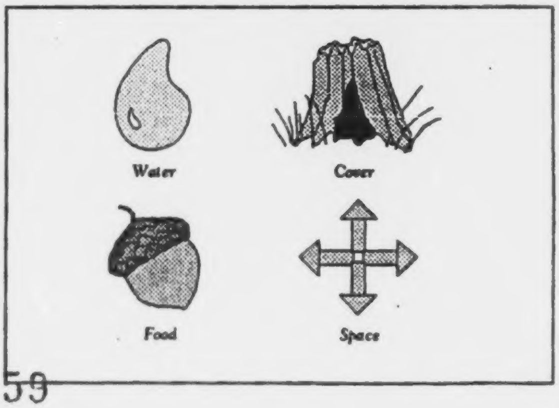
- Where does the plant live (habitat and microhabitats)?
- What does it need to survive?
- How does it reproduce?
- If the plant reproduces by seeds, how are they dispersed?
- What relationship does it have with other plants and animals?
- How does the plant influence its environment?
- What management practices are used to manage the plant?
- Does the plant have any beneficial (economic, medicinal, etc.) or negative qualities?
- Is it an endangered, threatened or watched species? What has caused the plant to be given this status?

Those selecting an animal should answer the following questions:

- What are the habitat requirements of the animal?
- How does it adapt to changes in seasons?
- What trophic level does the animal fill?
- Does the animal have a symbiotic relationship with another plant or animal? If so, how does each benefit?
- How does the animal influence its environment?
- What practices are used to manage the animal?
- Is the animal a game species or nongame species?
- Is it an endangered, threatened or watched species? What has caused the animal to be given this status?

4. Each group should select a member to draw a picture of their plant or animal in it's natural habitat.

5. Have the class create a prairie mural on a large piece of paper that depicts the physical environment. Start with only the nonliving components of a prairie ecosystem. These may include all or some of the following: sun, water, rocks, minerals, sand, dirt, bones and fossils. The physical environment should also include some topography such as stream valleys and rolling hills. Add the living components. The mural may also be drawn as a cross section showing the prairie soils underneath. Not only does this give the mural a three dimensional appearance, but it can show the burrowing habits of badgers, ground squirrels and mice.



6. When the mural is finished, have each group place the drawing of their organism in its appropriate habitat. Ask each team to explain their reasons for placing each organism in its particular location. When all of the organisms are in place, discuss the following questions:

- What did you learn about your prairie plant or animal?
- How does it rely on its physical environment for survival?
- Is it a threatened or endangered species? If so, how did it become endangered or threatened?
- Is anything being done to manage the habitat on which it depends?

7. Introduce the web of life concept. Place a push pin next to each plant and animal. Use a long piece of yarn to connect each organism to others that it relies on for food and shelter. Students can help by acting as your expert about each of the species they researched.

8. Ask each team to make sure that its organism is correctly tied to the other organisms depicted on the mural. The completed mural forms a web of life for this ecosystem.

9. Discuss these questions:

- What would happen if any one component of the ecosystem were missing? How would this effect the other organisms?
- How does nature's web of life compare to your own community?

Extensions:

1. Identify the major types of prairie found in Illinois and the factors that make each unique. Research how the amount of prairie changed as Illinois was settled. Create a state map showing the distribution of each type of prairie as it existed at the time of settlement and another map as it exists today.
2. Research the big bluestem and when and why it was selected as the state prairie grass.
3. If the class were given the responsibility of selecting a state prairie insect, bird and mammal, what species would they select? Why?
4. Repeat the exercise using a different habitat, such as a wetland, forest or cave.

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Adapted with permission from Project Learning Tree.

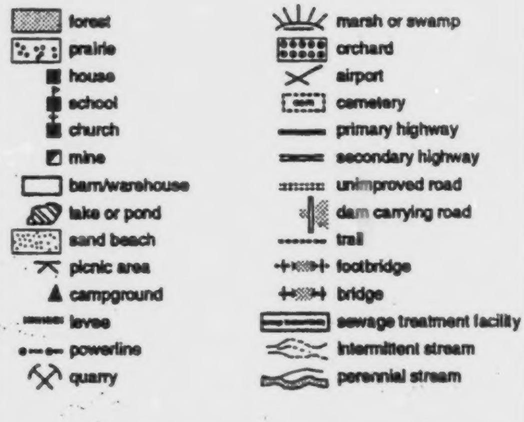
Topographic Maps

See related Lesson Plan "Habitat Management" (page 21) and "Design a Resource Management Area" (front pocket).

Maps are an important tool for the natural resource manager. Managers must be able to read a map to be able to locate specific features and learn about the site. Managers must also be able to create a map to use in presentations on how they recommend a site be managed.

A series of symbols has been developed that are common to most maps (figure 1). These symbols allow information to be presented in a clear and brief manner that can be interpreted with little training.

Figure 1


forest
prairie
house
school
church
mine
barn/warehouse
lake or pond
sand beach
picnic area
campground
levee
powerline
quarry
marsh or swamp
orchard
airport
cemetery
primary highway
secondary highway
unimproved road
dam carrying road
trail
footbridge
bridge
sewage treatment facility
intermittent stream
perennial stream

One type of map commonly used is a topographic map. These maps are available for most parts of the United States and are based on a rectangular survey system adopted in 1785 by the Federal Government. Topographic maps are based on a series of north-south lines (principle meridians) and east-west lines (base lines). The intersections of these lines served as the starting point for surveyors to subdivide the surrounding area. One subdivision is a township, which is six miles square. Townships are named based on their location north or south of the base line (township) and east or west of the principle meridian (range) (figure 2).

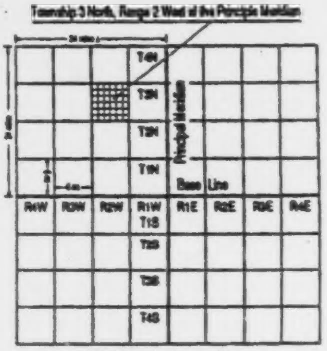
Each township can be divided into 36 squares, called sections, each 1 mile on a side and containing 640 acres (figure 3). Some townships may not be exactly 1 mile square or contain 640 acres due to survey corrections for the curvature of the earth. Each section can be subdivided into smaller and smaller units as shown in figure 4. References to a portion of a section are made by dividing the section into a series of "quarters."

To describe a tract of land, start with the smallest unit and progress to the largest. For instance, the tract noted in figure 4 would be the SE_, SE_, Sec. 9, T3N, R2W, 3PM, Coles County, Illinois. To locate this tract on a map, you would start reading at the end of the string and work your way back to the beginning.

Using the topographic map on page 54 , locate the following features.

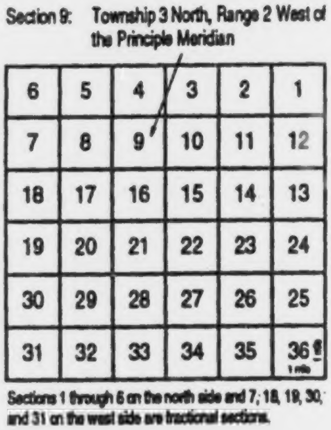
LOCATION	Highest Elevation	Lowest Elevation	Direction of Water Flow
Sec. 8, T13N, R11W	______	______	______
Sec. 33, T14N, R11W	______	______	______
Sec.4, T13N, R11W	______	______	______
Sec.5, T13N, R11W	______	______	______

Figure 2


Township 3 North, Range 2 West of the Principle Meridian
24 miles
24 miles
T4N
T3N
T2N
T1N
Principal Meridian
Base Line
6 mi
6 mi
R4W
R3W
R2W
R1W
R1E
R2E
R3E
R4E
T1S
T2S
T3S
T4S

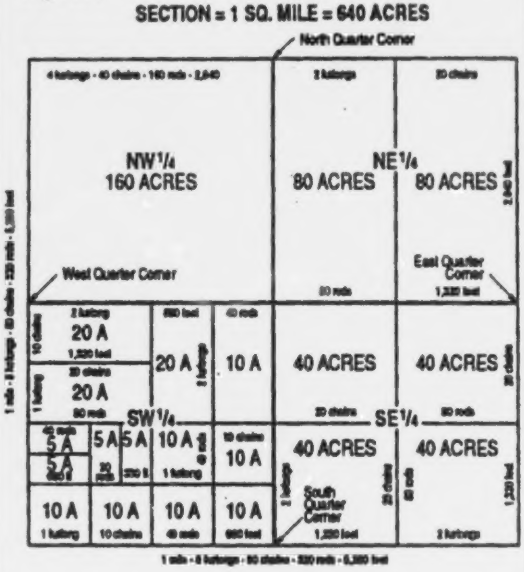
Dividing an area into townships.

Figure 3


Section 9: Township 3 North, Range 2 West of the Principle Meridian
6 5 4 3 2 1
7 8 9 10 11 12
18 17 16 15 14 13
19 20 21 22 23 24
30 29 28 27 26 25
31 32 33 34 35 36
1 mile
Sections 1 through 6 on the north side and 7, 18, 19, 30, and 31 on the west side are fractional sections.

A township divided into sections

Figure 4


SECTION = 1 SQ. MILE = 640 ACRES
North Quarter Corner
NW¼
160 ACRES
NE¼
80 ACRES
80 ACRES
West Quarter Corner
East Quarter Corner
20 A
20 A
20 A
10 A
40 ACRES
40 ACRES
SW¼
SE¼
5 A
5 A
5 A
5 A
10 A
10 A
40 ACRES
40 ACRES
10 A
10 A
10 A
10 A
South Quarter Corner

Section of land showing acreage and distances

Locate a radio tower on the map. Describe the location to the nearest 80 acres.

Locate a school on the map. Describe the location to the nearest 10 acres. How far from the school is the nearest named stream?

Give the section, township and range for these structures.

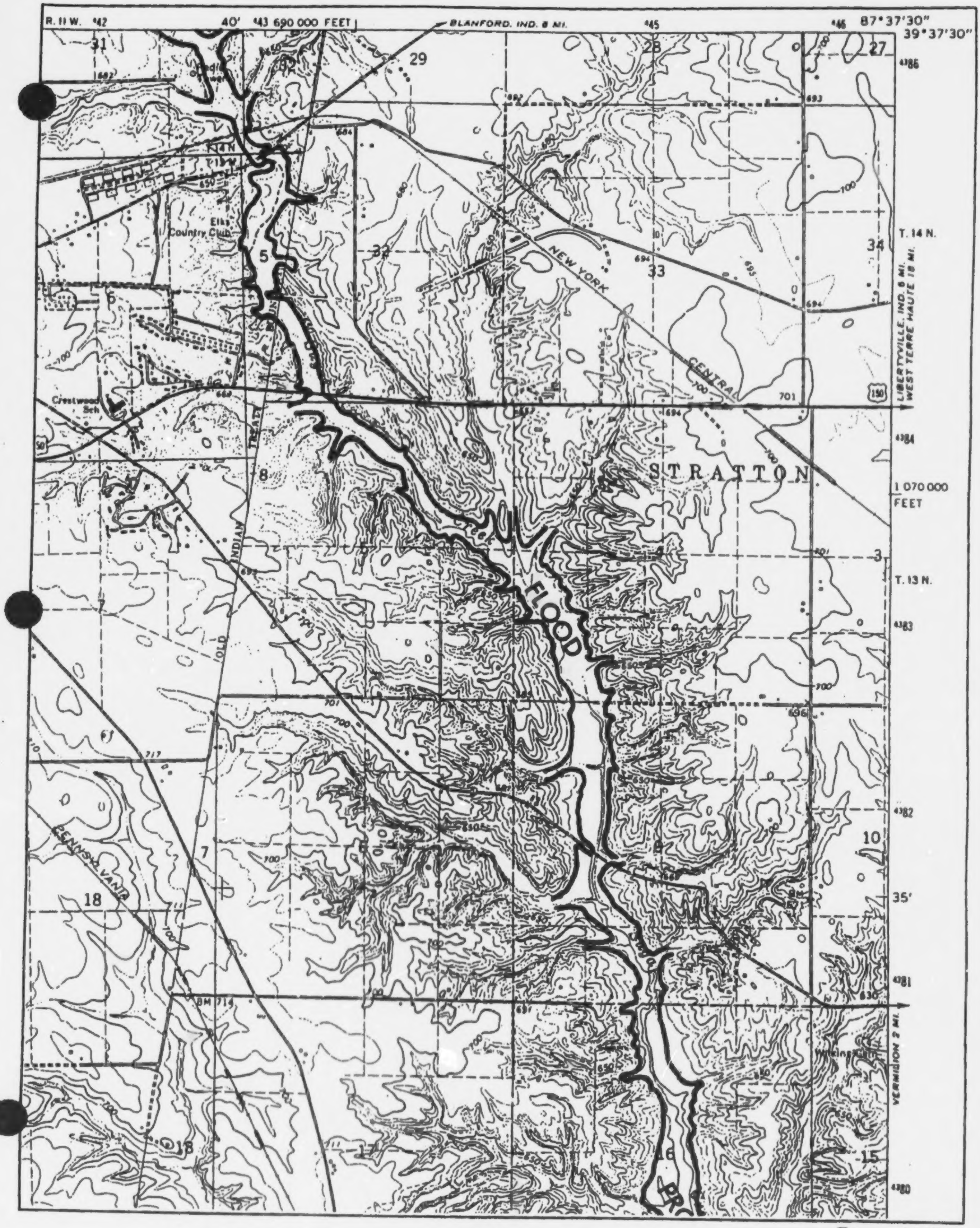
- Country Club S___, T___, R___
- Wilkins Cemetery S15, T___, R___

Which section has the most buildings?

- S___, T___, R___

Which section is the flattest?

- S___, T___, R___


R. 11 W.
442
40'
443 690 000 FEET
BLANFORD, IND. 8 MI.
445
446
87°37'30"
39°37'30"
31
32
29
28
27
4386
T.14 N.
T.13 N.
Elks Country Club
5
32
33
34
NEW YORK
CENTRAL
6
Crestwood Sch.
50
150
LIBERTYVILLE, IND. 5 MI.
WEST TERRE HAUTE 18 MI.
4384
STRATTON
1 070 000 FEET
8
4
3
FLOOD
4383
INDIANA
OLD
7
7
9
10
4382
18
PENNSYLVANIA
35'
BM 714
4381
VERMILION 2 MI.
18
17
16
15
4380

Topographic Map

Taking A Survey

See related Lesson Plans "Who Are The Users?" (page 7),"Conflicts, Resolutions and Planning" (page 11) and "Taking Action" (page 35).

Often before a project is initiated in a community, a survey is taken of the people the project will effect. Surveys measure the degree of knowledge and interest, or the opinions and attitudes held toward an idea. Surveys may be written or verbal and completed by the participant or through an interview. The population to be questioned may be general (people walking down the street) or specific (campers/joggers/those who apply for a fishing license) but those chosen to participant should be selected randomly. The purpose of the survey should be clear and the questions designed to be non-leading and unbiased. Instructions should be easy to follow.

Surveys can take a variety of styles: checklists, questions with yes/no answers, ranking system, or narrative. Below are examples of various survey styles. The style or combination of styles chosen will depend on the particular questions asked and the final results desired or required. The following questions represent samples of survey types previously used.

Instructions

Working in teams, students should select a natural resource topic that is of interest to them. Topics to be considered may be natural resource issues of a local, state, national or global concern, such as wetland protection, endangered/threatened species, the wood product industry or protection of recreational opportunities. Newspapers and magazines may provide ideas for current issues.

Students should review the various styles of surveys (below) and select a style or styles to be used in their survey. Questions and instructions should be prepared and critiqued to ensure they meet the intended goal of the survey. A decision should be made of the population that will be surveyed, such as the general public, students in their classroom, parents of freshmen, fishermen or bicyclists. The group should decide on the number of surveys that will be taken, keeping in mind the important factor is the random sampling of the targeted population. After the survey is complete, results should be tallied and a report prepared. Consideration should be given to how the information collected could be best used, such as submitted to decision makers or published in a newspaper.

Checklist

Which of the following should be the main purpose of the Illinois State Park System?

__ To offer families/groups a nice place to get together
__ To provide a place for children to play
__ To protect natural resources
__ To provide recreation for people
__ All of the above

Yes/No

Are you a hunter? Yes__ No__
Did you purchase a fishing license this year? Yes__No__

Number Ranking System

Of the following outdoor concerns, please rank in order the five concerns which are of greatest importance to you, with #1 being the greatest concern.

___ Preservation of natural areas
___ Better environmental education
___ Protect wildlife habitat
___ Protect wetlands
___ More trails for hiking, bicycling & other activities
___ More funding for public recreation
___ Better local recreation facilities & programs
___ Better protection of and access to rivers and lakes

Opinion Ranking

In your opinion, how responsible should each of the following groups be for promoting ethical behavior among outdoor recreationists? (Circle appropriate number for each category: "1" for very responsible to "5" for least responsible)

	Very Responsible				Least Responsible
A. Media/TV, radio, magazines	1	2	3	4	5
B. Family	1	2	3	4	5
C. Peers/local clubs	1	2	3	4	5
D. Schools	1	2	3	4	5
E. Organized recreation groups	1	2	3	4	5

If you visit state parks, how satisfied are you with the opportunities for

	Very Satisfied	Satisfied	Dissatisfied	Very Dissatisfied	Don't Know
Camping?					
Picnicking?					
Fishing?					
Hunting?					
Lodging?					
Hiking?					

Narrative

What solutions can you suggest to improve any hazardous environmental conditions in your community?

____
____
____
____
____
____
____
____
____

Combination

In the last 12 months, did you:

	Yes	No	If "Yes" how many days did you participate?
Go fishing	___	___	___
Go horseback riding	___	___	___
Go snowmobiling	___	___	___
Go trapping	___	___	___
Observe wildlife or birdwatch	___	___	___

GLOSSARY

abiotic - non-living

Abiotic factors such as temperature of the air and water have a major influence on living things.

aesthetic - having to do with art, beauty and appearance

Aesthetic qualities are a matter of individual taste.

alluvium - sedimentary deposits created by running water

Alluvium is found underneath much of central Illinois plains.

anthropocentric - focused on human values

Resource management decisions that put human values first are considered *anthropocentric*.

authority - the power or right to act or make decisions

A Conservation Police Officer has the *authority* to issue a citation to anyone who violates hunting laws.

biotic - pertaining to life

Biotic members of an ecosystem need food and water to survive.

biocentric - focused on biologic values

Biocentric values are based on consideration for all living things.

bog - wet, spongy ground; marsh; swamp

The endangered pitcher plant can only be found in *bogs* in the northeastern part of the state.

carrying capacity - the maximum size of a population that can be supported by the resources of the area it occupied

After the flood the *carrying capacity* of deer mice decreased because of the loss of food and cover.

chute - an inclined channel

The meander *chute* formed during the flood created an oxbow lake.

clearcut - the timber management strategy of harvesting all trees in a given area, regardless of size or species

When a *clearcut* makes space and resources available, these new niches will soon be filled by the most competitive species.

climax species - plant and animal species found in a stable ecological community

Some of Illinois' *climax species* such as wolves, bears and cougars no longer roam freely.

commercial - relating to business or trade
Commercial fur trapping and trading was once a thriving business in Illinois.

compliance - the act of obeying a request, wish or demand
Catch and release fishing tournaments often rely on voluntary *compliance*.

compromise - a method of settling differences in which each side yields
Major resource management decisions rely on a great deal of *compromise*.

concise - brief and to the point
The teacher's instructions were clear and *concise*.

contour - a line on a map or chart connecting points of the same elevation
The *contour* lines on the map showed the hills.

census - an official count of the individuals living in a specific geographic area
Last year's *census* showed a large increase in the number of giant Canada geese in the Mississippi flyway.

competition - the use of a limited resource by two or more individuals of the same or different species
The *competition* between two or more birds for a nest site can be fierce.

consensus - an opinion held by all or most
It was the *consensus* of lawmakers that smoking in public buildings should be banned.

constituent - any group interested in or affected by the policies and programs of a public organization
Canoeing enthusiasts were one of the many *constituent* groups that attended the meeting.

consumer - any organism that feeds on other organisms
A *consumer* cannot absorb energy directly from the sun.

correspondence - communication by exchange of letters
The couple kept a close *correspondence* while they were away at school.

degradation - the process of going from a higher to a lower quality
Erosion of Illinois topsoil is one form of environmental *degradation*.

density - the number of inhabitants present in a defined area
The Great Flood of '93 decreased the density of many Illinois game fish.

diversity - the variety of species present in a given area
A tall grass prairie has much more plant diversity than a corn field.

ecosystem - the combination of the biotic and abiotic resources of a given area
Most people are unaware that rocks, minerals and soil are all components of every ecosystem.

ecosphere - the regions of the earth that are capable of supporting life
The tropical rainforests and coral reefs are the two most productive ecosystems of the earth's ecosphere.

electroshock - a biological sampling technique that uses alternating currents to temporarily stun fish for counting, measurement and study
The *electroshock* study showed less reproduction in non native species.

emigration - the movement of individuals or groups away from an area
Clearing the forest will start an *emigration* of animals in search of new habitat.

energy pyramid - a symbolic way of showing the decrease in solar energy transferred from plants at the bottom of the food chain to animals at the top of the food chain
The *energy pyramid* shows that only 10% of the sun's energy passes from plants to herbivores.

endangered - faced with the danger of extinction
The pitcher plant, snowy egret and river otter are three Illinois *endangered* species.

estimate - to make a rough calculation or educated guess
Wildlife biologists often *estimate* migratory waterfowl populations to show annual trends in population levels.

even-aged management - a timber management strategy resulting in tree stands of the same age
The conversion of a pasture to closely-spaced rows of white pine is one form of *even-aged management*.

exotic - from another part of the world; foreign
Many of Illinois' undesirable plant and animal species are *exotic*.

extirpated - to be destroyed or exterminated
Once *extirpated* from the state, the wild turkey and beaver have both made a remarkable comeback.

fen - a type of wet meadow
After trotting through the meadow, a young deer paused next to the *fen* for a drink of spring water.

floodplain - a flat area bordering a river that is likely to flood
A *floodplain* is considered a temporary wetland habitat.

food chain - a diagram of a feeding sequence which depicts the flow of food, energy and materials in an ecosystem

Some animals, like the black bear, eat at more than one level in the *food chain*.

food web - interwoven food chains

A *food web* shows how the many plants and animals of an ecosystem are dependent upon one another.

forb - a non woody, non grass plant usually found in a field or a meadow

Prairie leadplant was a common Illinois *forb*.

fossorial - adapted for or used in digging or burrowing

The mole and badger are *fossorial* mammals.

game - wild animals, birds or fish hunted for food or sport

Illinois upland *game* species include rabbit, ring-necked pheasant and bobwhite quail.

gill netting - a vertically set fishing net that entangles free-swimming fish by their gills

The *gill net* was set perpendicular to the shore to catch fish as they migrated upstream.

group selection - a timber management strategy of harvesting trees in one-quarter to two acre clusters

The *group selection* and increased sunlight allowed honeysuckle and black locust saplings to grow.

habitat - the place where an animal or plant naturally lives and grows

The versatile white-tailed deer has adapted to several different *habitats*.

humus - a dark substance found in soil containing decaying organic matter

Illinois' prairie soils consist of glacial deposits and *humus* that began forming two million years ago.

hydrophytic - a plant that grows in water or is adapted to a very wet environment

A key feature of wetlands is the predominance of *hydrophytic* plant species.

implementation - to put into practical effect; carry out

Implementation of a new law is difficult when the public is uninformed.

immigration - the movement of individuals or groups into an area

Clearing the forest will start an *immigration* of plants and animals to the transformed habitat.

individual tree selection - a timber management strategy which harvests specific trees

Individual tree selection does not provide enough sunlight for young oaks to grow.

innovative - something new or creative
Conservationists are seeking *innovative* ways to preserve our natural resources.

intermittent stream - a stream that stops and starts at intervals
Intermittent streams are found in areas with large formations of limestone near the surface.

intrinsic value - that which makes something special; uniqueness
When the diseased old shade tree was cut down, the old man saved a branch because of its *intrinsic* value.

legend - a caption that explains elements found on a map or chart
The *legend* provides symbols to interpret features of the map.

legislative - having the power to create laws
The General Assembly is the only *legislative* body with the power to create state laws.

limiting factor - an element needed by an organism that is least abundant in an environment
If the amount of dissolved oxygen in a lake is low, it becomes the *limiting factor* for all oxygen-breathing organisms in the lake.

management - the practice of managing, supervising or controlling
The most effective resource *management* techniques are based on flexible procedures.

marsh - low, wet land
Cattails, bulrushes and reeds are common *marsh* plants.

meander - to follow a winding and turning course
The river begins to *meander* when it approaches rocky terrain.

mesic - an environment with well drained soil and ample rainfall
Basswood trees typically occur in *mesic* forests.

microhabitat - the part of an organism's habitat that is most often occupied by the organism
Although our dog roams freely about the neighborhood, its *microhabitat* is our backyard.

monoculture - the practice of growing the same crop in the same field year after year
A *monoculture* of corn or beans can deplete the soil of vital nutrients.

mortality - death rate
Harsh weather or an abrupt change in climate can increase the *mortality* of many species.

natality - birth rate
The *natality* of a given population is heavily influenced by the amount of available food.

niche - the role or place an organism or species has in its environment
The deer mouse occupies the *niche* of an herbivore.

nonconsumptive - a use of a resource that does not degrade or destroy the resource
The observation of wildlife is a *nonconsumptive* use.

nongame - species that are not hunted for food or sport
Nongame species such as birds, mice, snakes and most turtles are an important part of a healthy ecosystem.

nonrenewable resource - a resource that is used up over time
Coal, natural gas and petroleum are examples of *nonrenewable resources.*

old growth forest - a woodland that has not been disturbed by humans
The majority of *old growth forests* in the United States are located in the Pacific northwest.

perennial streams - continuously flowing waterways
Most *perennial streams* are fed by a combination of groundwater and surface run-off.

perpetual resources - a limitless resource according to a human time frame.
Ocean tides, sunlight, and wind currents are examples of *perpetual resources.*

philosophical - having wise and enlightening qualities
The old man had many *philosophical* stories to tell.

pioneer species - plants and animals that are first to colonize new landforms and freshly plowed fields
Soon after dunes form, *pioneer species* of plants such as nodding wild rye and sea rocket become established.

plan - a way of doing something that has been thought out ahead of time
The agency spent one year developing a master management *plan* for the new park.

poachers - people who illegally harvest or possess plants or animals
Poachers have no respect for conservation laws or property rights.

population - a collection of organisms of the same species
The decline of the native *population* is due to the loss of habitat and invasion of non-native species.

population crash - the reproduction of an organism beyond the habitat's ability to support it
A summer of abundant food followed by a long and abnormally cold winter caused a *population crash* in deer mice.

predation - the capturing, killing and consumption of prey
Predation is an important part of a healthy ecosystem.

prey - an animal that is hunted, killed and used for food by another animal
Mice are *prey* for owls and snakes.

prescribed fire - a management tool used to remove undesirable species or stimulate growth of desired species in a forest or grassland by burning
The biologist recommended a *prescribed fire* to keep weeds out of the prairie.

public hearing - an official public proceeding, usually conducted by a hearing officer, to accept testimony on an issue causing conflict
Before the dam was built, a *public hearing* was held to resolve land use conflicts.

public meeting - a proceeding to accept public comment on a proposed project conducted by a representative of the agency conducting the business
The *public meeting* showed overwhelming support for the nature preserve.

renewable resource - a resource capable of being replaced by nature in a fairly short amount of time
As a *renewable resource*, trees can be harvested and regeneration or replanting will provide continued harvesting.

scale - a line of measurement on a map used as a key to show relative distance
According to the map *scale*, the river was about 10 miles long.

second growth forest - a woodland community that has developed and matured after old growth forest vegetation has been removed or altered.
Illinois forests left untouched since early pioneers removed trees are now *second growth forests*.

seed tree cut - a timber harvest strategy that requires the removal of all but a few seed-producing trees
By leaving a few mature red oak, the *seed tree cut* will make replanting unnecessary.

seining - a method of catching fish which uses a small meshed fishing net with floats on the top and weights on the bottom
While *seining* along the shoreline, the biologists found many species of game fish.

shelterwood cut - a timber harvest strategy that removes certain trees and leaves some for shelter allowing the growth of young trees that grow best in shade.
The space provided by the *shelterwood cut* has been taken over by more competitive species.

species - a group of plants or animals that resemble each other in appearance and behavior
Most *species* of large birds will stay with the same mate until death.

threatened - any species likely to become endangered in the foreseeable future
The bobcat and river otter are two Illinois *threatened* species.

topographic - a type of map that displays the exact physical features of its regions
The *topographic* map showed hills, rivers, homes and an airport.

transition species - plants and animals that are capable of colonizing a habitat that has been modified by pioneer species; between pioneer and climax species
Willow and sumac are often the first *transition species* to colonize a low-lying grassland.

tributary - a stream or river flowing into a larger stream or river
Illinois' river system consists of varying sizes of *tributary* streams.

trophic level - feeding level
Some organisms, such as humans, are capable of living at different *trophic levels*.

turgor pressure - internal pressure that inflates cells with water and makes plant tissue rigid
The wilted appearance of a plant is a direct result of a loss in turgor pressure.

uneven-aged management - a timber management strategy which results in tree stands of different ages.
The various sizes of trees created by *uneven-aged management* attracts a large variety of wildlife.

watershed - the total land area that provides water to a river or stream
The Illinois River has the state's largest *watershed*.

Resource Conservation

REFERENCE MATERIAL

This list of publications does not imply endorsement by the Department of Conservation and is provided only as an aid to the educator and reader.

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AUDIOVISUALS AND COMPUTER PROGRAMS

Most of these products have not been previewed and, therefore may not necessarily represent the policies and programs of the Illinois Department of Conservation. We recommend you preview the material to determine its applicability to your classroom and students. If not stated, the target grade level is unknown.

AUDIOVISUALS

Careers

Careers in Forestry

A videotape depicting career opportunities for forestry graduates. Rental, $25 from Forest Media Center, College of Forestry, Oregon State University, Corvallis, OR 97331, 503/754-4702.

Earth People—Careers in Natural Resources and the Environment

Presents career possibilities in the natural resources. Grades 9-12, 15 minutes, $79.95 from Charles Clark Co., Inc., 170 Keyland Court, Bohemia, N.Y. 17716, 800/247-7009.

Natural Resources: A Career Choice That Matters

Discusses natural resources a good career option and shows students and professionals from diverse cultures and in rural and urban settings. Grades 6-12, 6 minutes, $15 from Society of American Foresters, 5400 Grosvenor Lane, Bethesda, MD 20814.

Ecology

Ecology: Populations, Communities and Biomes

Explores the functional interrelationships among organisms within populations, communities and biomes. Grades 7-12, $195 from Charles Clark Co., Inc., 170 Keyland Court, Bohemia, N.Y. 17716, 800/247-7009.

Ecology—Sampling Methods and Field Techniques

This laboratory-oriented program simulates techniques ecologists use to study the environment. Grades 7 and up, $195 from Charles Clark Co., Inc., 170 Keyland Court, Bohemia, N.Y. 17716, 800/247-7009.

The Ecosystem: Network of Life

Discusses the interactions between living things and between organisms and the physical elements of the environment. Grades 7-12, 11 minutes, from Phoenix Films, Inc. (BFA Educational Media), 468 Park Ave. South, New York, 800/221-1274.

Natural Resources

Forestry: An Intricate Balance

Portrays forest resources of the United States, the demands we place on forests and the need to balance demands. Ages 9-adult, 12 minutes, $25 from Society of American Foresters, 5400 Grosvenor Lane, Bethesda, MD 20814.

International Association of Fish and Wildlife Agencies and the National Shooting Sports Foundation

Have produced videos, which are no longer available from the organizations but may be in your local or school library or available from a local sportsmen's organization. Look for titles such as *Hunting as a Choice* (ages 12-14), *The Un-Endangered Species—The Success of Wildlife Management in North America.* (A comprehensive package to familiarize junior and senior high students with successes of wildlife management in restoring many once endangered species to healthy numbers) or *What They Say About Hunting* (based on a brochure of the same title, the video explores the position statements on hunting made by the nation's major conservation and preservation organizations).

Natural Resources

Review the scientific and historical background necessary to make intelligent judgments about resource issues today. Grades 7 and up, $119 from Charles Clark Co., Inc., 170 Keyland Court, Bohemia, N.Y. 17716, 800/247-7009.

The New Explorers Series

With Bill Kurtis and a co-production of WTTW/Chicago and Kurtis Productions, Lt. VHS videocassette and an accompanying teacher's guide available for $34.95 plus shipping and handling. To order: The New Explorers c/o N-CORE, Lorain County JVS, 15181 Route 58 South, Oberlin, OH 44074 or 1/900-621-0660. Some available titles:

- *Crisis: Planet Earth*—infrared scanning of the Earth's temperature
- *A Twentieth-Century Medicine Man*—ethnobotany in the Brazilian rainforest
- *Super Seeds*—scientists studying growth of stronger crops
- *The Great Chicago Flood*—mathematical equation and computer modeling of the 1992 flood
- *From Beneath the Ashes*—recovery after the Yellowstone National Park fire of 1988
- *Children of the River*—international river-monitoring system conducted by children
- *Journey to Save a Crane*—research to save a rare crane species
- *Test Tube Zoo*—high-tech reproductive methods to save endangered species
- *Flight for Survival*—relocation of eaglets to an area where they no longer exist

The Rainforest Rap

World Wildlife Fund. 1250 Twenty-fourth Street NW, Washington, D.C. 20037.

Renewable Energy Resources: Wind, Water and Solar Rays

An evaluation of alternative energy sources and their possibilities in light of increasing oil prices. Grades 7-12, 47 minutes, $195 from Charles Clark Co., Inc., 170 Keyland Court, Bohemia, N.Y. 17716, 800/247-7009.

Replanting the Tree of Life

A film or videotape discussion of the role of trees and forests, including a discussion of historic use and abuse of trees. Grades 7-12, 20 minutes, rental $40 from Bullfrog Films, Oley, PA 19547.

The Spirit of Nature

A wildlife musical program featuring a 50-minute videocassette, two audio tapes and a 45-page teacher's workbook. Ages 6-adult, $199.95 for kit ($29.95 VHS cassette only) from Environmental Media, P.O. Box 1016, Chapel Hill, NC 27514, 900/368-338.

Vanishing Animals of North America

National Geographic Society, Educational Services, Dept. 85, Washington, DC 20036. Filmstrip with cassette. Advanced grade levels.

People

A Prophet for All Seasons

Aldo Leopold's life history and selections from his book *A Sand County Almanac.* Contact: NorthWord, Inc., Box 128, Ashland, WI 54806, 800/336-5666.

The Wilderness World of Sigurd F. Olson

Describes the life and spirit of Sigurd Olson, who fought for preservation of wilderness in the northwoods. Contact: NorthWord, Inc., Box 128, Ashland, WI 54806, 800/336-5666.

Water and Aquatic Organisms

Amphibians: Frogs, Toads and Salamanders

Illustrates an amphibian life cycle and studies the differences between these three groups of amphibians. Grades 6-12, 11 minutes, from Phoenix Films, Inc. (BFA Educational Media), 468 Park Avenue South, New York, 10016, 800/221-1274.

The Creek

U.S. Fish and Wildlife Service, Manley Miles Building, 1405 South Harrison Rd., East Lansing, MI 48824.

Fresh Water Pond

U.S. Fish and Wildlife Service, Manley Miles Building, 1405 South Harrison Rd., East Lansing, MI 48824.

Swamp

U.S. Fish and Wildlife Service, Manley Miles Building, 1405 South Harrison Rd., East Lansing, MI 48824.

A Swamp Ecosystem

National Geographic Society, Educational Services, Dept. 88, Washington, DC 20036, 800/368-2728.

Water

A discussion of freshwater ecosystems and the impact that damming and diversion has on the systems. Grades 7-12, 59 minutes, from Bullfrog Films, Oley, PA 19547, 800/543-FROG.

Water: A Precious Resource

A film or videotape discussion of the water cycle. Grades 6-12, 23 minutes, from National Geographic Society, Educational Services, Department 91, Washington, DC 20036, 800/378-2728.

Water: We Can't Live Without It

Grades 6-12, filmstrip or slides from National Wildlife Federation, 1400 16th St., NW, Washington, DC 20036-2266, 800/432-6564.

The Wetland Nightmare: Solutions for Local Government

$15 plus $1.50 postage from Washington State Department of Ecology, Cashiering Section, P.O. Box 5138, Lacey, WA 98503-0210, 206/459-6774.

What is a Fish?

Discussion of bony fish, their behavior and morphology. Grades 9-12, 20 minutes, from Encyclopedia Britannica Educational Corporation, 310 S. Michigan Avenue, Chicago, IL 60604, 800/544-9862.

Why Wetlands

Federation of Ontario Naturalists, 355 Leesmill Rod., Don Mills, Ontario M3B 2W8, 416/444-8419.

A World in Our Backyard: A Wetlands Educational and Stewardship Program

A series for students and teachers about using local wetlands as outdoor classrooms produced by the U.S. Environmental Protection Agency. Ages 10-14, 24-minute VHS cassette (16 minutes for teachers and 7 minutes for students) from Environmental Media, P.O. Box 1016, Chapel Hill, NC 27514, 900/368-3382.

COMPUTER PROGRAMS

Oh Deer

A real-life model on a neighborhood problem with deer over-population. Participants make decisions on the ideal size of the deer herd. Requires Apple II with 48k memory and 5 1/4 disk. Grades 5-9 from MECC 2390 Lexington Ave. North, St. Paul, MN 55126, 612/481-3550.

Fish Banks, Ltd.

An engaging group role-playing simulation of managing a fishing company to maximize assets. Involves intense analysis and negotiation and modeling of fish/ship interactions. From the National Diffusion Network. Kit includes a manual, transparencies, Macintosh or IBM PC disk, game board, wooden ships and fish money. $100 from IPSSR-Hood House, University of New Hampshire, Durham, New Hampshire, 03824, 603/862-2186.

Focus on Forests

Designed to help students develop critical thinking and creative problem-solving skills. Includes topics such as trees and where they grow in the United States, soil types, climatic and topographic variations, wildlife species inhabiting six major forest groupings and attitudes of various people towards the natural resources. Includes disk, teacher's manual, color wall map of forests and tree of the United States and a Project Learning Tree poster. Requires Apple IIe or IIc. $19.95 + $3 s/h from American Forest Foundation, 1250 Connecticut Ave., Suite 320, Washington, DC 20036.

Resource Conservation

Environmental Careers *(Partial Listing)*

Air Quality Control
Animal Behavior
Arborist
Artist
Crypotzoologist
Energy Conservation
Entomology
Environmental Chemistry
Environmental Design and Architecture
Environmental Economics
Environmental Education
Environmental Enforcement
Environmental Engineering
Environmental Health
Environmental Journalism
Environmental Law
Environmental Lobbying
Environmental Planning
Environmental Restoration
Fisheries Management
Forest Management
Hazardous Waste Management
Land Use Planning
Limnology
Mammalogy
Naturalist
Marine Biology and Resource Management
Parks and Recreation
Photography and Videography
Range Management
Soil Conservation
Solid Waste Management
Water Conservation
Water Quality Control
Wildlife Management
Zoo Keeper

Books:

Anon. 1993. *Job Opportunities in the Environment-1994*. Peterson's Guides, Princeton, NJ.

Basta, Nicholas. 1991. *The Environmental Career Guide-Job Opportunities with the Earth in Mind*. John Wiley, NY.

Environmental Careers Organization. 1993. *The Complete New Guide to Environmental Careers*. Island Press, Washington, D.C.

Miller, Louise. 1992. *Careers for Animal Lovers and Other Zoological Types*. NTC Publishing Group, Lincolnwood, IL.

Miller, Louise. 1991. *Careers for Nature Lovers and Other Outdoor Types*. NTC Publishing Group, Lincolnwood, IL.

Shenk, Ellen. 1992. *Outdoor Careers-Exploring Occupations in Outdoor Fields*. Stackpole Books, Harrisburg, PA.

Stienstra, Tom and Robyn Schlueter. 1992. *Carrers in the Outdoors*. Foghorn Press, San Francisco.

Periodic Publications:

Earth Work, monthly publication by the Student Conservation Association, P.O. Box 550, Charlestown, NH 02603, 603/826-4301 ($29.95 a year).

Environmental Job Opportunities by the Institute for Environmental Studies, 500 North Park St., 15 Science Hall, Madison, WI 52706 ($10.00 for ten publications/year).

National Directory of Internships by the National Society of Internships and Experiential Education, 3509 Haworth Drive, Suite 207, Dept. GM, Raleigh, NC 27609-7229, 919/787-3623 ($24.50)

Resource Conservation

QUOTES

We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect.	Aldo Leopold
In country, as in people, a plain exterior often conceals hidden riches, to perceive which requires much living with.	Aldo Leopold
That land is a community is the basic concept of ecology, but that land is to be loved and respected is an extension of ethics...All ethics so far evolved rest upon a single premise: That the individual is a member of a community of interdependent parts. His instincts prompt him to compete for his place in the community, but his ethics prompt him also to cooperate....	Aldo Leopold
In wilderness is the preservation of the world.	Henry David Thoreau
I go to the mountains as a particle of dust in the wind.	John Muir
When we try to pick out something by itself, we find it hitched to everything else in the universe.	John Muir
Awareness is becoming acquainted with environment, no matter where one happens to be. Man does not suddenly become aware or infused with wonder; it is something we are born with. No child need be told its secret; he keeps it until the influence of gadgetry and the indifference of teen-age satiation extinguish its intuitive joy.	Sigurd F. Olson
If we can change our priorities, achieve balance and understanding in our roles as human beings in a complex world, the coming era can well be that of a richer civilization, not its end.	Sigurd F. Olson
Man has been on a spaceship all this time. It is a tiny little spaceship, only 8,000 miles in diameter...and yet this tiny spaceship is so superbly designed that it provides everything man needs for his journey through space.	R. Buckminster Fuller
The pattern of life, natural or managed, must fit the patterns of soil fertility.	William A. Albrecht
If a species becomes extinct, its world will never come into being again. It will vanish forever like an exploding star. And for this we hold direct responsibility.	David Day, 1981

The universe is so successful, I simply want to learn its principles and apply them rather than to exploit it blindly and fear for survival.	R. Buckminster Fuller
I have five senses you must reach if I'm to learn and you're to teach. With taste, touch, smell and sight so clear, why must I receive all sense by ear?	C. Harold Fabler
I sincerely believe that for the child, and for the parent seeking to guide him, it is not half so important to know as to feel. If facts are the seeds that later produce knowledge and wisdom, then the emotions and the impression of the senses are the fertile soil in which the seeds must grow. The years of early childhood are the time to prepare the soil. Once the emotions have been aroused—a sense of the beautiful, the excitement of the new and unknown, a feeling of sympathy, pity, admiration or love—then we wish for the knowledge about the object of our emotional response....It is more important to pave the way for the child to want to know than to put him on a diet of facts he is not ready to assimilate.	Rachel Carson
I recognize the right and duty of this generation to develop and use the natural resources of our land; but I do not recognize the right to waste them, or to rob, by wasteful use, the generations that come after us.	Theodore Roosevelt
Democracy, with its myriad personalities and increasing sophistication, must be fibred and vitalized by regular contact with outdoor growths—animals, trees, sun, warmth and free skies—or it will dwindle and pale.	Walt Whitman
Our entire society rests upon - and is dependent upon - our water, our land, our forests, and our minerals. How we use these resources influences our health, security, economy and well-being.	John F. Kennedy
The children must be drawn towards and not away from the woods and fields and waters and must be led to see more clearly that...a man cut off from fellowship with the creatures of the open air is like a tree deprived of all its lateral roots and trimmed to a single branch. He may grow down and up, but he cannot grow out.	Stephen Forbes, founder and first chief of the Illinois Natural History Survey
Forests precede civilizations, deserts follow them.	Francois-Auguste-Rene De Chateaubraind

Our lands were originally very good; but use and abuse have made them quite otherwise....	George Washington
The noblest task that confronts us all today is to leave this country unspotted in honor and unexhausted in resource...I conceive this task to partake of the highest spirit of patriotism.	Gifford Pinchot
If we are to maintain man's proper relationship to the land, it is plain that we must insist that our developers be more conservation-minded, and we must broaden the role of resource planning in the management of our national estate.	Stewart L. Udall
In Nature's infinite book of secrecy a little I can read.	William Shakespeare
I went to the woods because I wished to live deliberately, to front only the essentail facts of life, and see if I could not learn what it had to teach, and not, when I came to die, discover that I had not lived.	Henry David Thoreau
We come and go but the land is always here and the people who love and understand it are the people to whom it belongs for a little while.	Willa Cather
If future generations are to remember us more with gratitude than with sorrow, we must achieve more than just the miracles of technology. We must also leave a glimpse of the world as it was created, not just as it looked when we got through with it.	Lyndon B. Johnson
There are some who can live without wild things, and some who cannot. Like winds and sunsets, wild things were taken for granted until progress began to do away with them. Now we face the question whether a still higher 'standard of living' is worth its cost in things natural, wild and free. For us in the minority, the opportunity to see geese is more important than television, and the chance to find a pasque-flower is a right as inalienable as free speech.	Aldo Leopold
We are all environmentalists. If we care about the quality of the life we lead, about human values, we're environmentalists. This is an awareness and a commitment of the heart as well as of the mind.	Robert Redford
He who knows what sweets and virtues are in the ground, the waters, the plants, the heavens and how to come at the enchantments, is the rich and loyal man.	Ralph Waldo Emerson

Any nation is rich so long as its supply of resources is greater than the needs of its people. After that, no nation is self-supporting. Somewhere between these two extremes lies America and its problem of a world free from want.

Jay N. "Ding" Darling

Those who contemplate the beauty of the earth find reserves of strength that will endure as long as life lasts. There is symbolic as well as actual beauty in the migration of the birds, the ebb and flow of the tides, the folded bud ready for the spring. There is something infinitely healing in the repeated refrains of nature—the assurance that dawn comes after night, and spring after the winter.

Rachel Carson

We now have these forest reservations, refuges where the timber and its wild denizens should be safe from destruction. What are we going to do with them? . . . If it is worthwhile to establish these reservations, it is worthwhile to protect them.

Theodore Roosevelt and George Bird Grinnel, 1893

The purpose of science is not to conquer the land, but to understand the mechanisms and to fit man into the resources he has available on the planet on which he has evolved.

J.J. Hickey, 1974

In common with the forests, the bison herds seemed endless. But a tide of humanity drove westward, multiplying as it came. It was a characteristic biological force similar to those we habitually misjudge because of their small beginnings. If unchecked, they can take over the world while our backs are turned.

Durward Allen

Civilization is a state of mutual and interdependent cooperation between human animals, other animals, plants and soils, which may be disrupted at any moment by the failure of any of them.

Aldo Leopold

All living things are destined to die and be recycled as a part of the flow of energy through the life community. Which is to say, a creature must feed, and sooner or later it will be fed upon.

Durward Allen

How can you buy or sell the sky, the warmth of the land? This idea is strange to us. There is no quiet place in the white man's cities. No place to hear the unfurling of the leaves in spring or the rustle of insects wings....And what is there to life if a man cannot hear the lonely cry of the whippoorwill or the arguments of the frogs around a pond at night? I have seen a thousand rotting buffalos on the prairie, left by the white man who shot them from a passing train. I am a savage and I do not understand how the smoking iron train can be more important than the buffalo that we kill only to stay alive. This we know, the earth does not belong to man; man belongs to the earth.

Chief Seattle, 1854

Progress is no longer an excuse for the destruction of our native animals and birds, but on the contrary implies not only an obligation, but an opportunity for the perpetuation.	Aldo Leopold
...in this headlong stampede for speed and ciphers we are crushing the last remnants of something (wilderness) that ought to be preserved for the spiritual and physical welfare of future Americans, even at the cost of acquiring a few less millions of wealth or population in the long run.	Aldo Leopold
Even the thinking citizen is too apt to assume that his only power as a conservationist lies in his vote. Such an assumption is wrong. At least an equal power lies in his daily thought, speech and action, and especially in his habits as a buyer and user of wood.	Aldo Leopold
There can be no doubt that a society rooted in the soil is more stable than one rooted in pavements. Stability seems to vary inversely to the mental distance from fields and woods. The disruptive movements which now threaten the continuity of human culture are born not on the land where the take originates, but the factories and offices where it is processed and distributed, and the capitols where the rules of division are written.	Aldo Leopold
All wilderness areas, no matter how small or imperfect, have a large value to land-science. The important thing is to realize that recreation is not their only or even their principal utility. In fact, the boundary between recreation and science, like the boundaries between park and forest, animal and plant, tame and wild, exists only in the imperfections of the human mind.	Aldo Leopold
Culture is a state of awareness of the land's collective functioning. A culture premised on the destructive dominance of a single species can have but a short duration.	Aldo Leopold
Conservation means land-health as well as resource supply. Land health is the capacity for self-renewal in the soils, waters, plants and animals that collectively comprise the land.	Aldo Leopold
A thing is right only when it tends to preserve the integrity, stability and beauty of the community, and the community includes the soil, waters, fauna, flora, as well as people.	Aldo Leopold
Nature speaks freely to the individual, but seldom harangues a crowd.	Charles C. Abbott

A man could be a lover and defender of the wilderness without ever in his lifetime leaving the boundaries of asphalt, powerlines and right-angled surfaces. We need wilderness whether or not we ever set foot in it. We need a refuge even though we may never need to go there. I may never in my life get to Alaska...but I am grateful that it's there. We need the possibility of escape as surely as we need hope; without it the life of the cities would drive all men into crime or drugs or psychoanalysis.	Edward Abbey
The sense of wonder, which is the possession of every child, is the one soonest lost for most of us. Life both sharpens and dulls us, and the ways in which it sharpens us are commonly less admirable than advantageous. But if we cannot, unless we are lucky, keep the sense of wonder undulled, we can remember what it was like when pleasure, whether of discovery or of recognition, was so sharp as to approximate pain.	Donald J. Adams
The young pine knows the secrets of the ground. The old pine knows the stars.	Unknown
Man is constantly adding to his knowledge of the world, but to do any good it must be shared - by the people.	Unknown
Somewhere today a worm has given up existence, a mouse has been slain, a spider snatched from the web, a jungle bird torn sleeping from its perch; else we should have no song of robin, nor flash of reynard's red, no humming flight of wasp, nor grace of a crouching ocelot. In tropical jungles, in northern home orchards, anywhere you will, unnumbered activities of bird and beast and insect require daily toll of life.	Charles William Beebe
Nature is a part of our humanity, and without some awareness and experience of that divine mystery, man ceases to be man.	Henry Beston
The sense of instinct is not flexible, like thought. It is rigid and unaltering, like the succession of the seasons.	Alan Devoe
For every creature under the sun there is a particular role in the natural scheme: for bees the bearing of pollen for the fertilization of plants and trees, for earthworms the aerating of the soil to make it fecund, for a crab or crawfish the scavenging of under-water earth. It is the grim and singular role of a weasel to kill—...to keep the mice from becoming too many and the cottontails from too far exceeding their number,...	Alan Devoe

We have all of us, men and animals, some special gift. One child takes to music, another is always modeling things in clay; another is quick at figures. It is the same way with insects. One kind of bee can cut leaves; another builds clay houses, spiders know how to make webs. These gifts exist because they exist, and that is all any one can say. In human beings we call the special gift genius. In an insect we call it instinct. Instinct is the animal's genius.	Jean Henri Fabre
...Nature ever...upbuilds one thing from other, suffering naught to come to birth but through some other's death.	Lucretius (98?-55 B.C.)
Observe always that everything is the result of change, and get used to thinking that there is nothing Nature loves so well as to change existing forms and to make new ones like them.	Marcus Aurelius (121-180 A.D.)
Greater familiarity with marshes on the part of more people could give man a truer and more wholesome view of himself in relation to Nature. In marshes, Life's undercurrents and unknowns and evolutionary changes are exemplified with a high degree of independence from human dominance as long as the marshes remain in marshy condition. They have their own life-rich genuineness and reflect forces that are much older, much more permanent, and much mightier than man.	Paul L. Errington Of Men and Marches
A frog does not drink up the pond it lives in.	Australian Saying
What is the use of a house if you haven't got a tolerable planet to put it on.	Henry David Thoreau
To look is one thing. To see what you look at is another. To understand what you see is a third. To learn from what you understand is still something else. But to act on what you learn is all that really matters.	The Talmud
You will find something more in the woods than in books. Trees and stones will teach you that which you can never learn from masters.	St. Bernard of Clairvaux
We cannot fail in following nature.	Montaigne
There is no other door to knowledge than the door nature opens; there is no truth except the truths we discover in nature.	Luther Burbank

In our every deliberation we must consider the impact of our decisions on the next seven generations.	The Great Law of Peace, Six Nations Iroquois Confederacy, late 16th century
In fact, there is nothing that keeps its youth so far as I know, but a tree and truth.	Oliver Wendell Holmes
A sustainable society is one that satisfies its needs without diminishing the prospects of future generations.	Lester Brown World Watch Report, April/May 1990
A man is truly ethical only when he obeys the compulsion to help all life which he is able to assist, and shrinks from injuring anything that lives. He does not ask how far this or that life deserves one's sympathy as being valuable, nor, beyond that, whether and to what degree it is capable of feeling. Life as such is sacred to him.	Albert Schweitzer
In recent decades we have slowly come back to some of the truths that the Indians knew from the beginning: that unborn generations have a claim on the land equal to our own; that men need to learn from nature, to keep an ear to the earth, and to replenish their spirits in frequent contacts with animals and with land. And most important of all, we are recovering a sense of reverence for the land.	Stewart Udall, *The Quiet Crisis*
Man always kills the things he loves, and so we the pioneers have killed our wilderness. Some say we had to. Be that as it may, I am glad I shall never be young without wild country to be young in.	Aldo Leopold
The days have ended when the forest may be viewed only as trees and trees viewed only as timber. The soil and the water, the grasses and the shrubs, the fish and the wildlife, and the beauty that is the forest must become integral parts of resource managers' thinking and actions.	Senator Hubert Humphrey, 1976
Each of the animals I write about I find beguiling in and of itself; but in all honesty there is no animal that isn't fascinating if viewed up close and in detail.	Diane Ackerman, *The Moon by Whale Light*
Fire presents opportunities for new life that don't exist until a burn. Each place responds in its own way and its own time. While the forests and grasslands of today are products of earlier fires, they're also setting the stage for fires to come.	Jack de Golia, *Fire: the story behind a force of nature*

HERE TODAY, GONE TOMORROW

OBJECTIVES

Students will be able to: 1) identify and describe some causes for extinction of animal species; 2) define "threatened," "rare," and "endangered" as applied to wildlife; and 3) name threatened and endangered animals living in their area.

METHOD

Students become familiar with classification of animals, conduct research, and make a master list of threatened and endangered animals locally and/or nationally, including factors affecting the animals' condition.

BACKGROUND

NOTE: This activity can be modified to include plant as well as animal species.

Pinpointing an exact number of species that become extinct each year is difficult. Many plants and animals are still unnamed and unknown. There is controversy surrounding estimates of species extinction rates. Some scientists estimate that human activity is responsible for 100 extinctions each day. Other scientists offer lower figures, but few experts disagree with the belief that the rate of species extinction is being accelerated by human actions. In 1991, the U.S. Department of Interior listed 457 plants and animals in the United States as being endangered, with an additional 153 listed as threatened. Many other species are under review for classification as threatened or endangered.

Although extinction is a natural process, excessive and intensive human activities in the environment have caused a dramatic increase in its rate. Loss of habitat as a result of human activity is considered to be the most pervasive cause of species extermination. Other major causes of species extermination and endangerment include: habitat modification, unregulated or illegal commercial and personal use, disruption of migration routes and breeding behaviors, contamination by pollutants, human disturbance, predator control, competition or predation from introduced species and natural causes.

Generally accepted definitions of the terms to be used in this activity are:

Endangered Species in immediate danger of extinction.

Critically Endangered Species will not survive without direct human intervention.

Threatened Species present in its range, but threatened because of a decline in numbers.

Rare Species not presently in danger, but of concern because of low numbers. NOTE: Some species were always rare because of their position in the food chain or due to habitat preference.

Extinct Complete disappearance of a species.

Peripheral Scarce in area because it is fringe or marginal habitat.

Listings of animals currently in these categories may be obtained from state or province wildlife agencies.

A list of the U.S. "Endangered Species" is available from:

Director, Office of Endangered Species
U.S. Fish and Wildlife Service
U.S. Department of Interior
Washington, D.C. 20204

State, province, and federal listings of endangered, threatened and rare species may vary because areas encompass different habitat conditions within their boundaries. An animal or plant may have been lost within one state's boundaries, but may be abundant in another, and therefore not considered threatened. The U.S. Endangered Species Act of 1973 gives authority to protect endangered species to the U.S. Secretaries of the Departments of Interior and Commerce, with responsibilities further delegated to the U.S. Fish and Wildlife Service and the National Marine Fisheries Service respectively.

The major purpose of this activity is to provide students with a working knowledge of the terminology and factors affecting potential elimination of wildlife species.

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MATERIALS

information from state and federal agencies about threatened and endangered animals; poster-making materials; writing materials

PROCEDURE

1. Contact your state or province wildlife agency. Ask for a list of animals in your state or province which are classified endangered, critically endangered, threatened, rare, extinct, and peripheral. Ask, too, for information regarding the reasons for these classifications. For older students and those wanting more depth: Write to the U.S. Department of Interior regarding any comparable information available at the national level. (See Background for address.) Also contact local chapters of conservation organizations (e.g., National Wildlife Federation, National Audubon Society, Defenders of Wildlife) for additional information they might have about species and habitats for which there is concern in your area.

2. Review and discuss with the students the definitions of **threatened, endangered, rare, extinct** and **peripheral**—as used in wildlife conservation, as well as in a dictionary. Understand that words defined in a standard dictionary may have additional legal connotations. Ask each student or group of students to select an animal to learn more about.

3. Ask one or more students to take the information accumulated from the wildlife agencies and private conservation groups and come up with a master list of the animals according to the category in which they can be classified, the classification both locally and nationally, and the principal factors affecting the animals. For example:

	State or Province						National						
Animal Name	Extinct	Endangered	Critically Endangered	Threatened	Rare	Peripheral	Extinct	Endangered	Critically Endangered	Threatened	Rare	Peripheral	Factors Affecting Animal's Status

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OR,
Divide the students into teams so they can all participate in constructing this chart; e.g., one team classifying mammals, another reptiles, birds, fish, insects, etc.

4. Make copies of this information for all the students. Discuss the findings. What seem to be the most prevalent factors affecting the animals; e.g., habitat loss, pollution, impact from introduced species?

NOTE: The U.S. Department of Interior listed the following numbers of endangered and threatened species in the U.S. in 1991: **Endangered**—54 mammals, 75 birds, 13 reptiles, 6 amphibians, 53 fish, 4 snails, 39 clams, 8 crustaceans, 16 insects, 189 plants = 457 endangered species; **Threatened**—6 mammals, 9 birds, 19 reptiles, 5 amphibians, 33 fish, 6 snails, 2 clams, 2 crustaceans, 9 insects, 62 plants = 153 threatened species.

EXTENSIONS

For Younger Students

1. Make a poster display showing the principal reasons for endangerment and the animals that are endangered in those ways. Poster displays could be made separately for both state and national endangered species.
2. Have a schoolwide contest in which students create posters honoring endangered species—from plants to wildlife.
3. Write a short essay, poem, or song about plants and animals facing extinction. What are these organisms "worth?" What are we humans losing?

For Older Students

1. Find out what is being done concerning the endangered plants and animals in your state or province; at the national level; at the international and worldwide levels. What can each of us as individuals do?
2. Each student can pick an endangered animal to find out more about. What will be the consequences of the disappearance of this species? What are the trade offs involved? What alternatives are available? What contributions does the animal make ecologically? Economically? Medicinally? Aesthetically? Intrinsically? Pool and discuss all the students' findings.
3. What animals and plants are known to be extinct? In each instance, what seem to be the causes?
4. Explore the possibility that extinction can apply to human cultural forms; e.g., traditional languages, native peoples.
5. In ten minutes, name as many animals as you can that are not legally endangered or threatened. Find out what species have been taken off the endangered species list, how and why.
6. Research, analyze, summarize and interpret findings related to the following question: Why care about endangered species?

AQUATIC EXTENSIONS

1. Find out what kinds of habitats the aquatic species are dependent upon. Find out more about the conditions affecting each of these aquatic species, their current status and projections for their likelihood of survival as a species.
2. Are factors affecting threatened and endangered aquatic species significantly different from those affecting terrestrial species? If yes, why? If no, why?

EVALUATION

1. Arrange the following terms in a list so that they progress from the least amount of danger to a species to the greatest amount: endangered, rare, threatened, extinct, critically endangered.
2. Describe two reasons for possible concern when animal species become extinct.
3. Who decides what species are endangered or threatened and how do they decide?
4. Describe principal causes for extinction.

Age: Grades 5-12
Subjects: Science, Language Arts, Social Studies
Skills: analysis, classification, discussion, listing, synthesis
Duration: two 30 to 45-minute periods
Group Size: any
Setting: indoors
Conceptual Framework Reference: I.D., II.A., II.B., II.C., II.D., II.E., II.F., III.D.3., III.D.4., IV.A., IV.C., IV.C.1., IV.C.2., IV.C.3., IV.C.4., IV.D.5., IV.D.6., IV.D.7., IV.E., IV.E.3., IV.E.4., IV.E.5., IV.E.7., IV.E.10., IV.E.11., IV.F., IV.F.3., IV.F.4., IV.F.5., IV.F.6., IV.F.7., IV.E.10., IV.E.11., IV.F., IV.F.3., IV.F.4., IV.F.5., IV.F.6., IV.F.7., I.V.F.8., IV.F.9., IV.F.11., VI.A., VI.A.2., VI.A.3., VI.A.4., VI.A.5., VI.C.13., VI.C.16., VI.D., VI.D.1., VI.D.2., VI.D.3., VI.D.4., VII.A., VII.A.1, VII.A.2, VII.A.3, VII.A.4, VII.B., VII.B.1, VII.B.2., VII.B.3., VII.B.4., VII.B.5., VII.B.6., VII.B.7.
Key Vocabulary: endangered, critically endangered, threatened, rare, extinct, peripheral
Appendices: Local Resources, Agencies and Organizations

DEER CROSSING

OBJECTIVES

Students will be able to: 1) identify various factors involved in a wildlife management issue; and 2) evaluate alternatives in a complex issue involving wildlife.

METHOD

Students are given background information and asked to make recommendations.

BACKGROUND

The major purpose of this activity is to provide students with an opportunity to analyze and evaluate complex factors that frequently arise in wildlife management issues. The situation used to illustrate this activity is based on actual occurrences involving a herd of deer in the state of Idaho.

MATERIALS

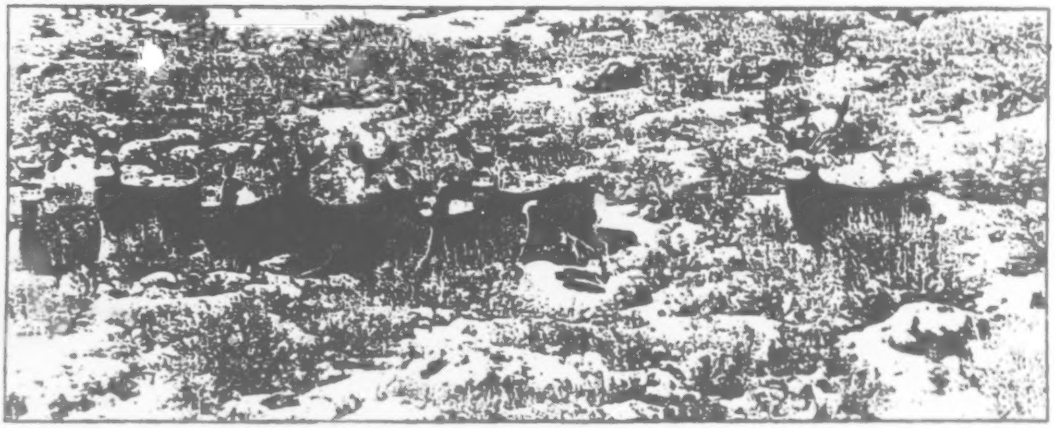
hand-out of information below

PROCEDURE

1. Provide groups of two to four students with the following background information, based on an actual situation in the state of Idaho. Ask the students, working in their groups, to read the information, discuss and evaluate options they think are available to resolve the situation in the best possible manner, and be prepared to offer and explain the recommendation of their group.

2. Ask the student groups to present and explain their recommendations. If students do not already have background, they may need to do research to prepare for their presentation. If additional research is not possible, the students can identify areas where they think additional information is needed—and why—before they feel they can make responsible recommendations. Where such points arise, ask for one or two students—if not more—to volunteer to get and verify this additional information. To formalize the reporting, each group could:

- describe the situation (or briefly review)
- provide background information
- identify and describe factors involved in the issue
- identify and describe alternative solutions, and
- state recommended action, with reasons



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DEER CROSSING

A major highway was to be built in an area previously served by an old road. Building the new highway would make it possible for auto travelers to get to a nearby town approximately six minutes faster than they could by the old road. The new highway would pose a major problem for a herd of deer in the area. Whereas the old road skirted a migration route used by the deer in moving between summer and winter feeding ranges, the new highway would lie directly in the path of the deer's migration.

The new highway was built, and it did block the deer's migration. The deer tried to cross the highway, but many were killed in the process in collisions with autos and trucks. People were also injured and some were killed. A large fence was built along both sides of this highway, in hopes of preventing the animals from trying to cross. Even so, some deer were able to cross, with collisions and fatalities still the result.

Most of the deer, however, were not able to jump the fence that was built. Instead, the majority of the herd bunched up on one side of the fence, without being able to cross. The problem was particularly critical each winter. The deer were trying to move out of the high mountains, where they spent the summer months, to get to lower feeding areas for the winter. There was not enough food for the deer if they could not get to their winter feeding area. They bunched up by the fence, ate any food in the area quickly, and began damaging the remaining vegetation and soil structure as they looked for food.

Every year since the highway was built, the state wildlife agency has brought in food for the hungry deer. Even so, some deer die from starvation each winter, while more than 1,500 are fed a pellet food. Deer being fed under these crowded conditions in a central feeding area are more apt to contract and spread disease. They also become accustomed to being fed by humans. The wildlife agency has taken several approaches to relieve this situation. A seven and one-half mile long fence was constructed to the north and east of the highway. This has helped to hold the deer farther north and helps to disperse the animals to minimize damage to the watershed in the vicinity of the feeding area. The U.S. Bureau of Land Management initiated a project to plant saltbush and bitterbrush on several hundred acres of land adjacent to this fence. An additional 1,500 acres has been seeded aerially. These bushes are now three to four feet high and provide natural winter range for the deer herd. Plans call for seeding another 3,000 to 4,000 acres, the acreage calculated as necessary to support a herd of 2,000 deer.

Consider the following possibilities—including costs and benefits of each—and any others that you might come up with that you think would be effective and appropriate:

- Issue hunting permits to reduce the size of the herd in the area
- Live-capture and transplant deer to areas where there is sufficient room and food for them to live
- Persuade the highway department to build underpasses or overpasses the deer can use to move from one feeding area to the other
- Keep feeding the deer artificially
- Let the deer starve
- Other?

EVALUATION

1. What are the factors involved in this deer problem? What are the values that must be considered by the people trying to solve this problem? How might the problem have been avoided, or at least solved less expensively?

2. Consider this situation: A stream, dammed for flood control five years ago, has become an area for a number of wildlife and human problems. Because of the quantity of still and warm water available, the mosquito population is up and the number of fish species is being reduced. Nutrients running off local farms have increased the growth of aquatic plants. The fishing, boating, swimming and picnicking use of the area has been reduced from the early years. However, flooding concerns for the city downstream virtually have been eliminated. The residents in the town do not report being bothered too much by the mosquitos.

List at least four factors that should be considered in this resource management issue. Identify, describe and evaluate at least four possible actions that could be taken to resolve the resource problems which have developed, attending to the diverse values represented in the community as well as overall wildlife and human needs. Select what you think is the most reasonable and appropriate solution, and explain your reasons.

Age: Grades 7-12
Subjects: Social Studies (Government, History, Civics), Language Arts, Environmental Problems, Science
Skills: analysis, description, discussion, evaluation, public speaking
Duration: two 45-minute periods or longer
Group Size: large group
Setting: indoors
Conceptual Framework Reference: IV.A., IV.A.1., IV.A.2., IV.A.3., IV.A.4., IV.E., IV.E.5., IV.E.10., IV.E.11., IV.F., IV.F.1., IV.F.2., IV.F.3., IV.F.4., IV.F.5., IV.F.6., IV.F.8., IV.F.11., V.A., V.A.5., V.B., V.B.1., V.B.2., VI.A., VI.A.1., VI.A.2., VI.A.3., IV.A.4., VI.A.5., VI.B., VI.B.1., VI.B.3., VI.B.4., VI.B.5., VI.B.6., VI.C., VI.C.1., VI.C.2., VI.C.6., VI.C.12., VI.C.15., VI.C.16., VI.D.1.
Key Vocabulary: land use, condemnation, deed
Appendices: None

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WHERE HAVE ALL THE SALMON GONE?

Objectives

Students will be able to: 1) interpret and make inferences about fluctuations in fish populations from actual data; and 2) analyze the effects of human use and habitat changes on a fish population.

Method

Students graph and interpret actual fish population data in relation to historical events.

Background

Data gathered about a wildlife population in a similar manner over a period of time may be useful in detecting trends in that population. The same data may be interpreted by those analyzing it in a variety of ways. Because a fish population is influenced by many factors, it may be difficult to measure the effect of a single factor. Thus, assumptions must often be made that factors other than the ones being measured are not significantly affecting the population.

In measuring populations of living creatures, biologists are seldom able to get a total count. Usually only a sample of the population can be obtained and inferences about the total population must be made from this sample. Errors or inconsistencies in gathering the data over time may greatly influence the accuracy of the data. Despite the influence of unknown factors and possible inconsistencies in data gathering, regularly conducted counts or inventories of a population may still be the best information available and decisions must be made from this information.

At times, biologists are simply unable to make any type of reasonably reliable count. How many fish are there in the sea, for example? How many of each species? There is simply no way to know. In these cases, some type of index to abundance may be used.

In this activity, actual data from fish catches from the Columbia River are provided for students to analyze. The fish species are all anadromous—that is, they migrate from the ocean to fresh water to spawn. Young fish live in the river from one to three years, return to the ocean, and grow to adults in several more years. The data are in pounds of fish caught in the river rather than the ocean.

The major purpose of this activity is for students to make inferences about factors that affect some fish populations.

Age: Grades 6—12
Subjects: Science, Math
Skills: analysis, classification, comparing similarities and differences, computation, identification, inference, interpretation, listing, media construction, reading
Duration: one or two 40-60 minute periods
Group Size: any
Setting: indoors
Conceptual Framework Reference: IV.A., IV.A.1., IV.A.2., IV.A.3., IV.A.4., IV.B., IV.B.1., IV.B.2., IV.C., IV.C.1., IV.C.2., IV.C.3., IV.C.4., IV.D., IV.D.1., IV.D.2., IV.D.3., IV.D.4., IV.D.5., IV.D.6., IV.D.7., IV.E., IV.E.1., IV.E.2., IV.E.3., IV.E.4., IV.E.5., IV.D.6., IV.D.7., IV.E., IV.E.1., IV.E.2., IV.E.3., IV.E.4., IV.E.5., IV.E.6., IV.E.7., IV.E.8., IV.E.9., IV.E.10., IV.E.11., IV.F., IV.F.1., IV.F.2., IV.F.3., IV.F.4., IV.F.5., IV.F.6., IV.F.7., IV.F.8., IV.F.9., IV.F.10., IV.F.11.
Key Vocabulary: population, inventory, trend

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Materials

graph paper; copies of fish catch data; information about each fish species and historical information

Procedure

1. Provide students with the fish catch data and information about each fish species only. Have them graph levels of each species caught from 1870 to the present. There will be five lines on the graph with each a different color to represent a different species.

Students should put a legend on their graphs. You may want to make an overhead for students to check against and for use in discussions.

Adapted from an activity by Patty Farthing in *Water, Water Everywhere*. Corvallis, OR: Oregon State University Extension Sea Grant Program, 1985. Used with permission.

The data below is taken from actual fish catches. Figures are in millions of pounds. The accompanying historical data provides an overview of human activities in the river plus developing regulatory and management efforts over time.

MILLIONS OF POUNDS OF FISH CAUGHT

YEARS	FISH 1	FISH 2	FISH 3	FISH 4	FISH 5
1870-79	22.7	—	—	—	—
1880-89	33.1	—	—	—	—
1890-99	24.1	3.2	0.8	2.4	3.0
1900-09	25.1	2.1	1.3	0.8	0.7
1910-19	28.1	4.3	3.6	0.9	1.9
1920-29	22.3	5.5	3.1	0.9	2.5
1930-39	17.2	3.2	1.2	0.3	1.9
1940-49	15.4	1.1	1.5	0.2	1.8
1950-59	7.4	0.6	0.2	0.3	1.1
1960-69	4.7	1.6	0.02	0.1	0.6
1970-79	5.9	1.9	0.01	0.2	0.4
1980-89*	5.4	1.9	0.01	0.06	0.3

* projected

2. Ask the students to list and explain whatever inferences they can draw from the data provided. Do the graphs show any long-term trends? Are there periods where the rates of fish caught change rapidly in a short time? What inferences about population abundance of each species can be made from the graphs and fish information? What other factors may be affecting the number of fish caught or population levels? Might the ways in which the fish are caught have changed? A new event or factor may take some time to have an effect on a population or to be detected. Do the graphs seem to show any of these situations in relation to historical events? Are there different interpretations that individual students make from the same information? Do each of the interpretations seem to explain or fit the information and data? If faced with making a management decision based on one of the interpretations, how would you decide which interpretation to use?

3. Provide the students with the historical background. Have them review this new information in relation to what their graphs show. It may be helpful for students to make notes on the graphs at the points where significant historical events occur. What new inferences can be made? Must some of the old inferences or explanations be changed to fit the new data?

NOTE: This activity does not address ethical questions related to the appropriateness or inappropriateness of catching fish for human uses. This dimension may be added at the professional discretion of the educator conducting the activity.

HISTORICAL DATA

1866	Opening of first fish cannery on the river.
1869-1883	Canning of Fish 1 jumped from 100,000 cases to 630,000 cases.
1880-1889	43 million pounds of Fish 1 taken from river by commercial fishers.
After 1883	Canneries begin to use other species of fish 2,3,4,5).
1877-1878	First efforts to regulate fisheries by state. Enforcement was limited but control of amount and type of fishing gear helped.
1900-1909	30 million pounds of all fish taken.
1915-1920	40-44 million pounds of fish taken as World War I inspired intensive use.
1920	Approximately 1,000 commercial trollers operating in ocean. At least that many boats in the river with gill nets, seines, and traps.
1933-1938	Construction of first dam on lower part of the river.
After 1935	Only gillnetters allowed on the river. All other commercial fishing techniques banned.
1941	Second dam built in upper river. No fish ladders installed.
1940-1950	Four new dams built on the river between existing dams.
1930-1950s	Extensive logging in lowest part of river systems.
1950s	Six dams built on the major tributary of the river.
1950s	Government launches a massive hatchery program for Fish 1, 2, and 5.
1953	Another dam built on main river.
1957	Another dam built.
1950-1960s	Ocean harvest rather than river harvest of Fish 1 and 2 increases greatly.
1968	Another dam built.
1968-1973	Extreme nitrogen supersaturation in river from dam spill of runoff water. Many small fish killed.
1960-1980	Fish hatchery techniques greatly improved on Fish 1, 2 and 5.
1970s	Commercial use of Fish 5 is banned.
1980s	Intensive regulation of ocean fishing on Fish 1 and Fish 2.

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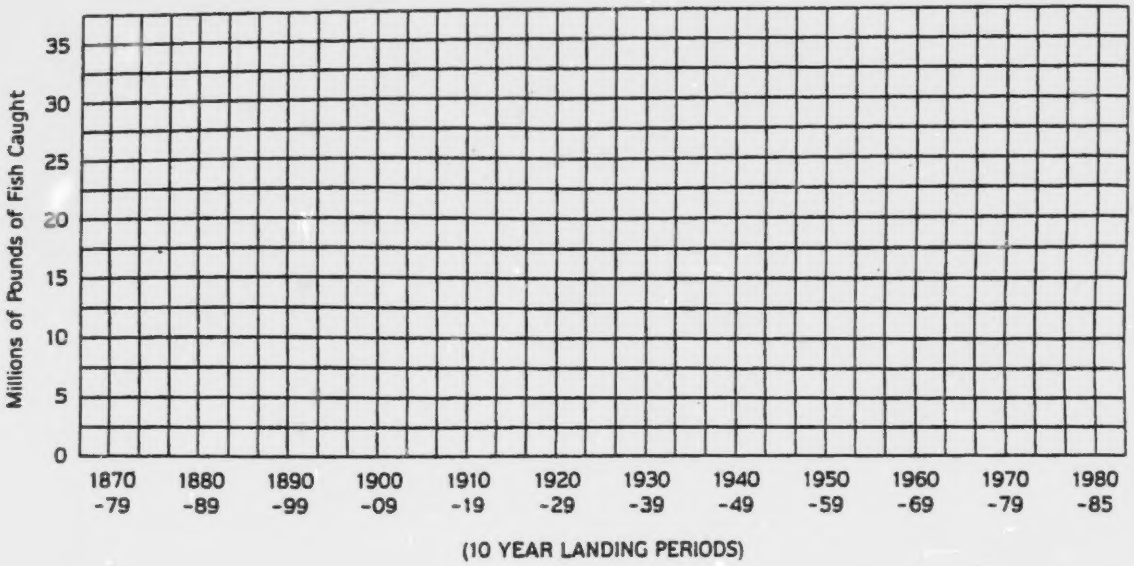


Below is information about each fish species that will be useful in analyzing data.

Fish 1 (Chinook): Considered to be the most abundant and valued fish species for catching. They migrate the entire length of the river. Largest in individual size of all fish.

Fish 2 (Coho): These fish are second to Fish 1 in popularity and economic value. They migrate only up to the lower middle part of the river system.

Fish 3 (Chum): Never popular. Do not bite a hook well. Found only near the mouth of the river. Usually caught with nets.

Fish 4 (Sockeye): Smallest-sized fish in the group. They migrate to the uppermost part of the river. They require lakes for successful spawning and rearing. Do not bite well. Taken mostly with nets.

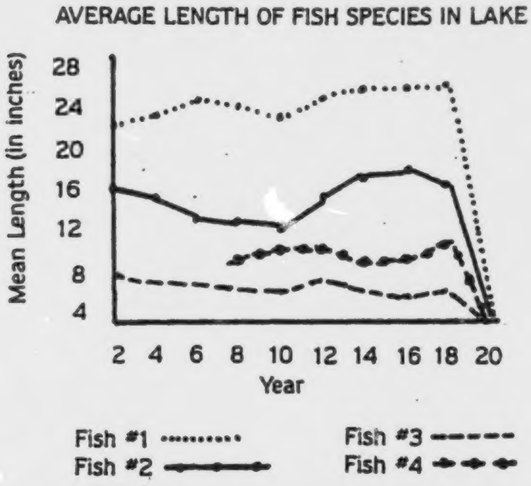
Fish 5 (Steelhead): These fish migrate throughout the river system. Habitat requirements are more restrictive than others.

Extensions

1. Contact your local department of fish and wildlife. Invite a fisheries biologist to review the data with you and make his or her analysis. Does it differ significantly from your own?
2. Write a short "scientific" paper explaining the data, analysis, and interpretations of the fish populations. Read your paper to the class, and defend your analysis.

Evaluation

Study the graph to answer these questions:



- Which fish population appears to be the most stable?
- Fish #3 appears to be a prey species for which fish?
- What would you think is the primary diet of Fish #1? Fish #2? Fish #3? Why?
- What natural and human events may have accounted for the decrease in Fish #2's size between years two and four, and between years 16 and 18?
- What effect did the introduction of Fish #4 appear to have on the other fish species?
- What actions might the local (state) fish agency have taken to maintain the size of Fish #2?
- What natural and human events may have caused all the fish species to die in year 20?

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Overview

In this activity, students will role-play managing a tree farm. By using a piece of land as a tree farm, they will begin to understand the economic factors that influence management decisions for private forest lands.

Background

The United States has 731 million acres (296 million ha) of forestland that make up about one-third of the total land base. Canada has 1,118.5 million acres or 453 million ha of forestland. To be classified as forestland, an area must be at least 1 acre (.4 ha) and contain about 10 percent tree cover. About 483 million acres (195.6 million ha), or two-thirds, of U.S. forestlands are also classified as commercial ***timberland*** (forests capable of growing merchantable crops of trees). Canada has 244 million acres (99 million ha) classified as commercial. U.S. commercial timberlands are owned by three sectors of society: private individuals own 57 percent; public agencies (federal, state, county) own 28 percent; and forest industries own 15 percent. Timberlands that are owned and managed by private individuals are often referred to as tree farms.

Tree farms are forests that are managed to grow trees for wood products such as paper and lumber. Like other forests, tree farms not only produce timber and other forest commodities, but also provide homes for wildlife, produce oxygen, reduce soil erosion, help protect water quality, and offer recreation areas. Although tree farmers often have different goals for managing their lands, most have one thing in common: they want to manage their forests in an aesthetically pleasing and ecologically sound way, while growing trees for forest products.

Silviculture is the practice of establishing and managing a forest to best meet the objectives of the owner. Tree farmers apply silvicultural techniques to maintain and enhance their forest-land. In doing so, they can control forest composition, structure, and growth. Through ***harvesting*** (tree removal), cutting, ***thinning, prescribed burning***, and various other methods, a tree farmer can manipulate the variety and age of tree species within a forest, the density of trees, the arrangement of different layers or stories of vegetation, and lighting and shading. Even before a forest matures, tree farmers must consider how the next forest will be regenerated and managed. The management techniques a tree farmer applies to his or her land not only affect the present forest but also influence its future characteristics.

For more specific information on silvicultural systems of management, refer to student page 250.

Getting Ready

Find a comfortable seating area indoors or outdoors where you can arrange students in rows. You'll divide your group into about five rows of roughly equal numbers. Prepare three signs that read FIREWOOD, PULP, and LUMBER which will go around students' necks. For the Enrichment, make copies of student page 250 for each team; for the Assessment, make copies of student page 251.

Doing the Activity

1. Ask students for the definition of a tree farm. Using the background information, explain that a tree farm is a forest ecosystem that provides many valuable products.

2. Place students in rows. After each is in place, tell students that they are now tree seedlings. You have planted them on a barren piece of land that you own. You want this land to be a productive tree farm, so you call the State Forest Service for advice. They recommend planting pine trees. They also help you develop a long-range management plan for your land.

3. Tell the "trees" that they have now been growing for 15 years, and they

LEVELS
Activity: Grades 4-8
Enrichment: Grades 6-8

SUBJECTS
Science, Math, Social Studies

CONCEPT

- Conservation and management technologies, when appropriately applied to the use or preservation of natural resources, can enhance and extend the usefulness of the resources as well as the quality of the environment. (11.2)

SKILLS
Identifying Main Ideas, Analyzing, Solving Problems, Synthesizing and Creating.

OBJECTIVES
Students will ● participate in a simulation designed to teach how forest resources are managed and ● simulate managing a piece of land for various products.

MATERIALS
Activity: Three pieces of cardboard and string to make three signs to go around students' necks
Enrichment: copies of student page 250
Assessment: copies of student page 251

TIME CONSIDERATIONS
Preparation: 30 minutes
Activity: 50 minutes
Enrichment: Two 50-minute periods

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need to be thinned so they can continue to grow quickly. If they are not thinned, they will become crowded and compete for food, water, and sunlight. Such competition will stunt their growth and make them more susceptible to insects and disease.

4. For this thinning, you will remove native hardwood "trees" such as oak, hickory, or maple that have occurred naturally in your pine plantation. These "trees" will be used for firewood. Place a FIREWOOD sign around one student's neck and have him or her stand to one side where the others can see. You will also need to cut some pine "trees" during this thinning. They will be grouped behind another student standing to the side wearing a PAPER sign (because pine trees will be turned into pulp for making paper). You should remove approximately every other "tree" during this initial thinning operation. You can designate these "trees" as firewood or paper and then have them stand behind the respective students.

5. Tell the remaining students that they have now grown for another 10 years and need to be thinned again. This time you will harvest every other pine "tree" for paper. This thinning will enable the remaining "trees" to continue growing at the maximum rate. All "trees" that are cut down will join the others already behind the PAPER sign. Explain that pulp from the trees will be used to make books, boxes, tissues, and other paper products.

6. After growing another 15 years, the remaining "trees" will be as big as they will probably get. If left as they are, they may be attacked by insects, infected by disease, or destroyed by wildfire. If any of these things happen, the "trees" will lose most, if not all, of their value as timber. Therefore, you have decided to harvest all remaining "trees" for lumber. Place the LUMBER sign on one student and begin to remove all remaining "trees." When all "trees" have been removed, explain that you will replant the land with several trees for every one that you removed in the final harvest. You may also opt to leave some mature seed trees standing for natural regeneration (see student page 250).

7. Line up all the "trees" in the same rows as the beginning and ask them what natural events could drastically change the forest. (Wildfire, insect infestation, or plant disease could kill many trees and plants and could greatly affect the ecosystem.) Discuss students' answers. Pretend you are a wildfire roaring through the forest and destroying the "trees" (all students sit down). Discuss the results: Wildlife is homeless; soil is charred; streams are choked with sediment and ash; valuable timber is lost. Explain that although you, the landowner, are very upset, fire is a natural, and sometimes vital part of the forest lifecycle. The forest will return through natural regeneration and planting.

8. Replant the forest so that all "trees" are back in their places. Tell the students that you have decided to retire and move away. Before you leave, you must sell the land. You sell to someone who isn't interested in forest management. This person has decided to develop the property for housing without consulting forest managers.

9. First, the new landowner puts in a road so prospective homebuyers can see the lots. Remove one row of "trees" and put them aside to be burned. (This is often what happens.) Next, remove some "trees" from the rows next to the road so homes can be built. (Again, put them in a brushpile to be burned.) Continue cutting down "trees" to make room for the construction of businesses, schools, and roads until all "trees" are gone. Ask the students, "Would you like to live in this community?" Point out the many benefits that trees provide for a development like this. (beauty, shade, recreation, clean air, and homes for animals) Discuss how the landowner could have developed this housing community with the assistance of foresters so that many of these benefits could have remained.

Enrichment

1. Divide students into forest management teams of three or four. Give each team a copy of student page 250.

2. Review this information with students to make sure they understand the forestry terms (also use the Glossary on page 371).

3. Tell each team they will lead the group through the same type of simulation they did in the activity, only they will make all management decisions.

4. Give teams about 20 minutes to plan a strategy for managing a forest in which students are the trees (the number of students in the group minus themselves). They can choose one of the silvicultural systems described on the student page, can use a combination of systems, or can make up their own system. Whatever they choose to do, they must explain each action they take.

5. Allow time for each team to lead the entire group through a simulation.

END NOTES...

ASSESSMENT OPPORTUNITY

Pass out copies of the Forest Stand puzzle on student page 251. Tell students to number Boxes A to F in a logical sequence. On the back of the page, have them describe the sequence of events and say what actions were taken in each box. (See possible Answers below).

RELATED ACTIVITIES

400-Acre Wood, A Forest of Many Uses, Forest Consequences, Tree Lifecycle, Nothing Succeeds Like Succession, Who Works in This Forest?

REFERENCES

Smith, D.M. *The Practice of Silviculture, 8th ed.* New York: John Wiley & Sons, 1986.

Society of American Foresters with cooperation of The Wildlife Society. Choices in Silviculture for American Forests. Washington, DC.: Society of American Foresters, 1981.

POSSIBLE ANSWERS TO ASSESSMENT

1. (c) A young pine forest is planted on barren land.

2. (a) Several trees are removed for firewood.

3. (e) With initial thinning after 15 years, removed trees are used for firewood or paper.

4. (d) With pulpwood thinning after 20 years, removed trees are used for paper.

5. (b) With harvesting of mature trees for lumber after 40 years, a few mature seed trees are left for regeneration.

6. (f) When seed trees are harvested for lumber, young seedlings are growing.

FOREST SILVICULTURAL SYSTEMS

Silviculture is the practice of growing and managing forests to control their composition, structure, and growth. Forests are frequently managed in smaller units called stands. A stand is a group of trees similar enough in species composition, condition, and age distribution to be considered a unit. Stands may be even-aged (trees are of relatively the same age) or uneven-aged.

A forest manager can choose among several systems of silviculture to harvest and grow new trees within a forest stand. These include the clearcutting, seed-tree, shelterwood, and single tree and group selection systems.

In the *clear-cutting system*, all trees in a stand are harvested at once, with the expectation that a new, even-aged stand becomes established. The clear-cut system works well for establishing trees that grow best in full sunlight. The new stand may develop by seeds from nearby stands, from seeds stored in the forest floor, or from stump or root sprouts of cut trees. In other cases, a clear-cut area is regenerated by scattering seeds or by planting seedlings.

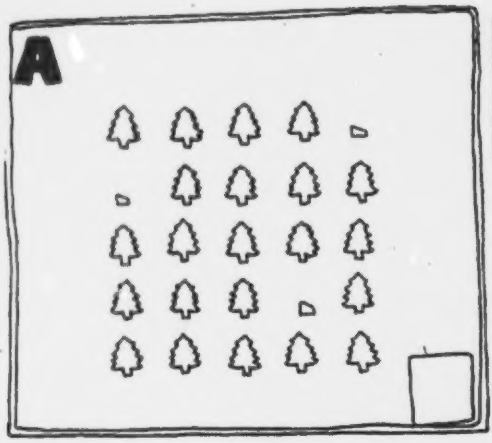
The *seed-tree system* requires leaving a few good seed-producing trees on each stand when the mature stand is harvested. These trees provide the seeds needed to regenerate a new, even-aged stand. The seed trees are sometimes harvested after a crop of new, young trees has become established.

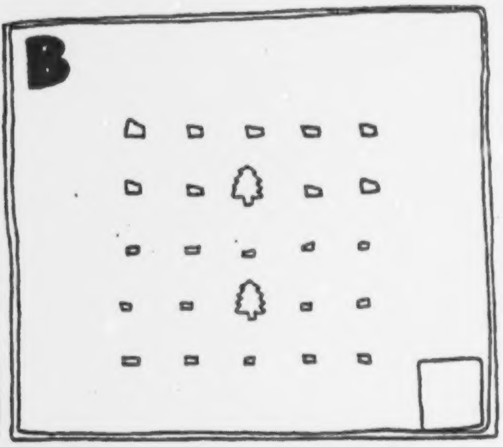
The *shelterwood system* involves a series of partial cuttings over a period of years in the mature stand. Early cuttings improve the vigor and seed production of remaining trees and prepare the site for new seedlings. The remaining trees produce seeds and shelter young seedlings. Later, cuttings will harvest shelterwood trees and allow regeneration to develop as an even-aged stand.

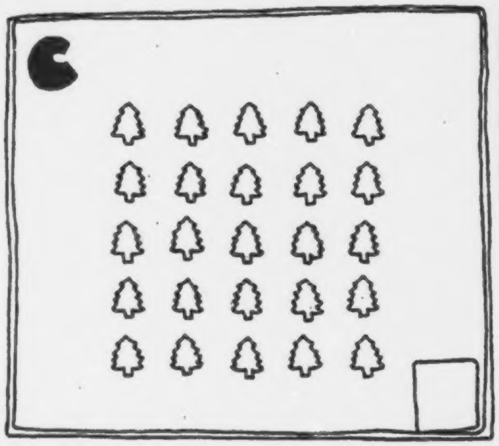
The *single-tree selection* system differs from the other systems by creating and maintaining an uneven-aged stand. Foresters examine a stand and judge each tree on its individual merit. Trees are harvested as they mature. Seedlings or sprouts grow in the spaces created. Periodic thinning and harvesting results in a stand that contains trees of many ages and sizes. Because relatively few trees are harvested at any one time, and because the forest floor is generally shaded, this system favors species that thrive in low light.

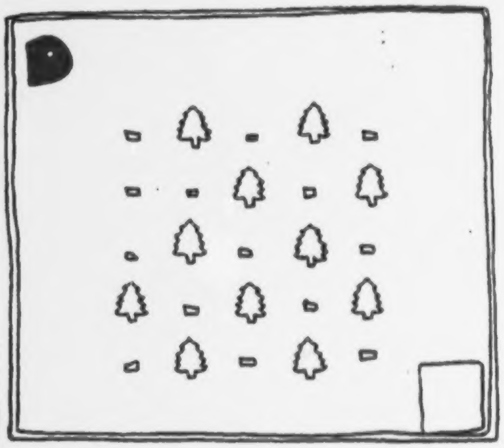
The *group selection* system requires harvest of small groups rather than individual trees. The openings created resemble miniature clear-cuts, with the major difference being that the resulting regeneration occupies too small an area to be considered an even-aged stand. As in the single-tree system, both thinning and harvest cuttings are done at the same time. The new trees that grow in these small openings are regarded as parts of a larger stand containing trees of many ages. In either single-tree or group selection systems, frequent harvests are needed to maintain a balance of tree ages, classes, and sizes.

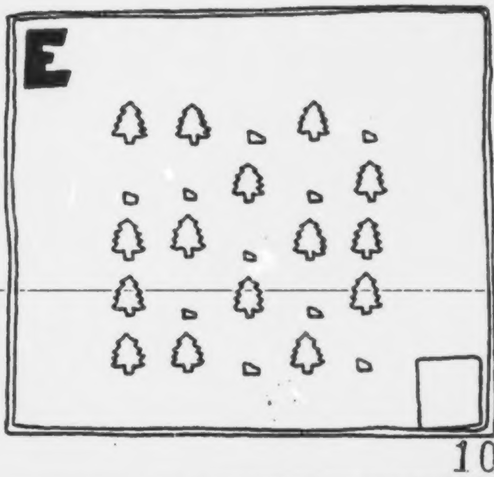
FOREST STAND PUZZLE

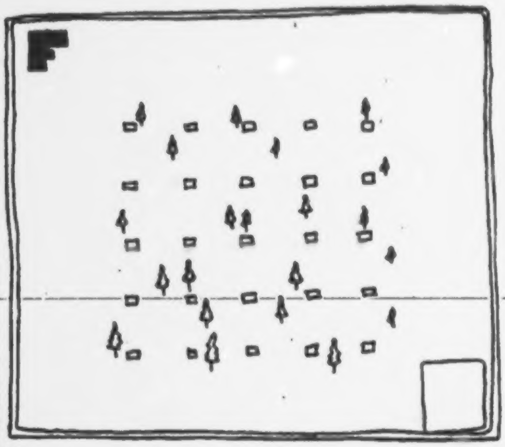




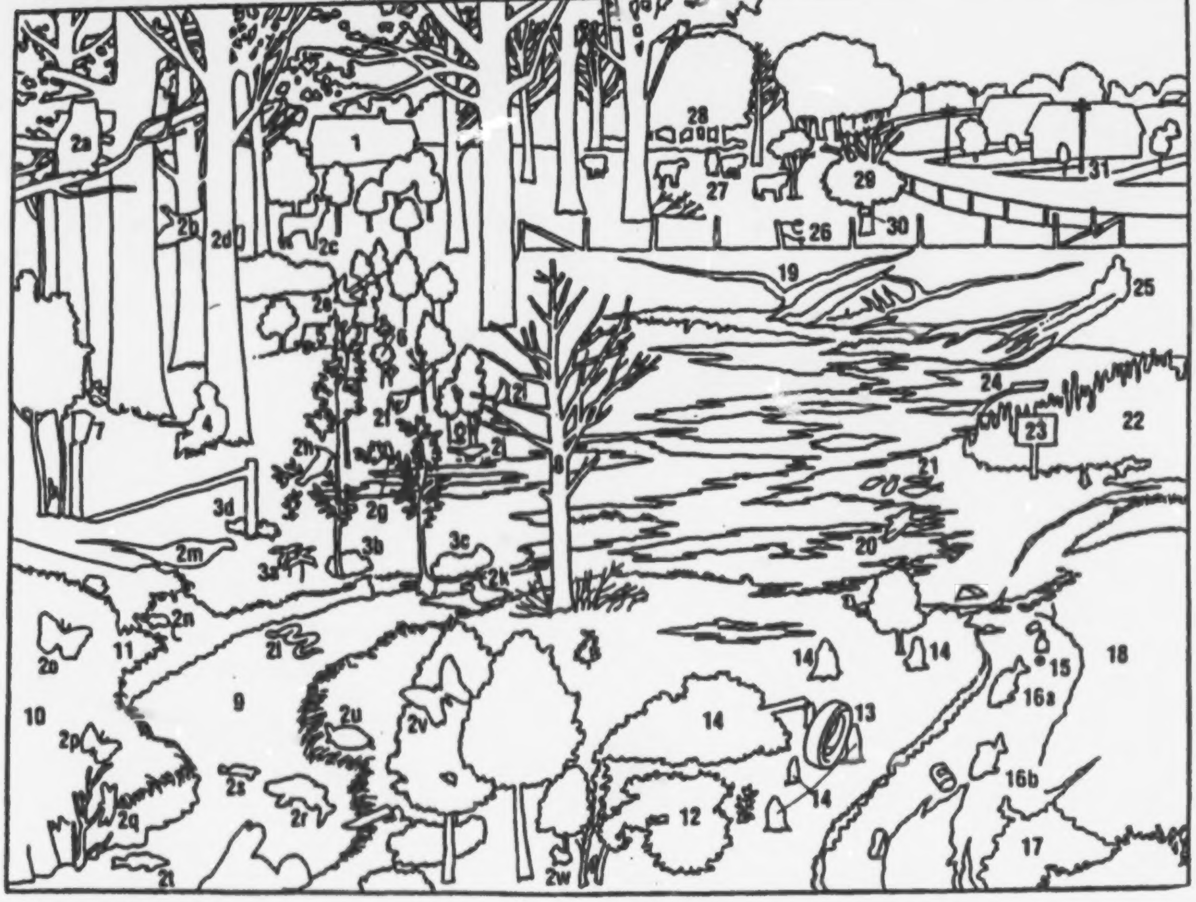






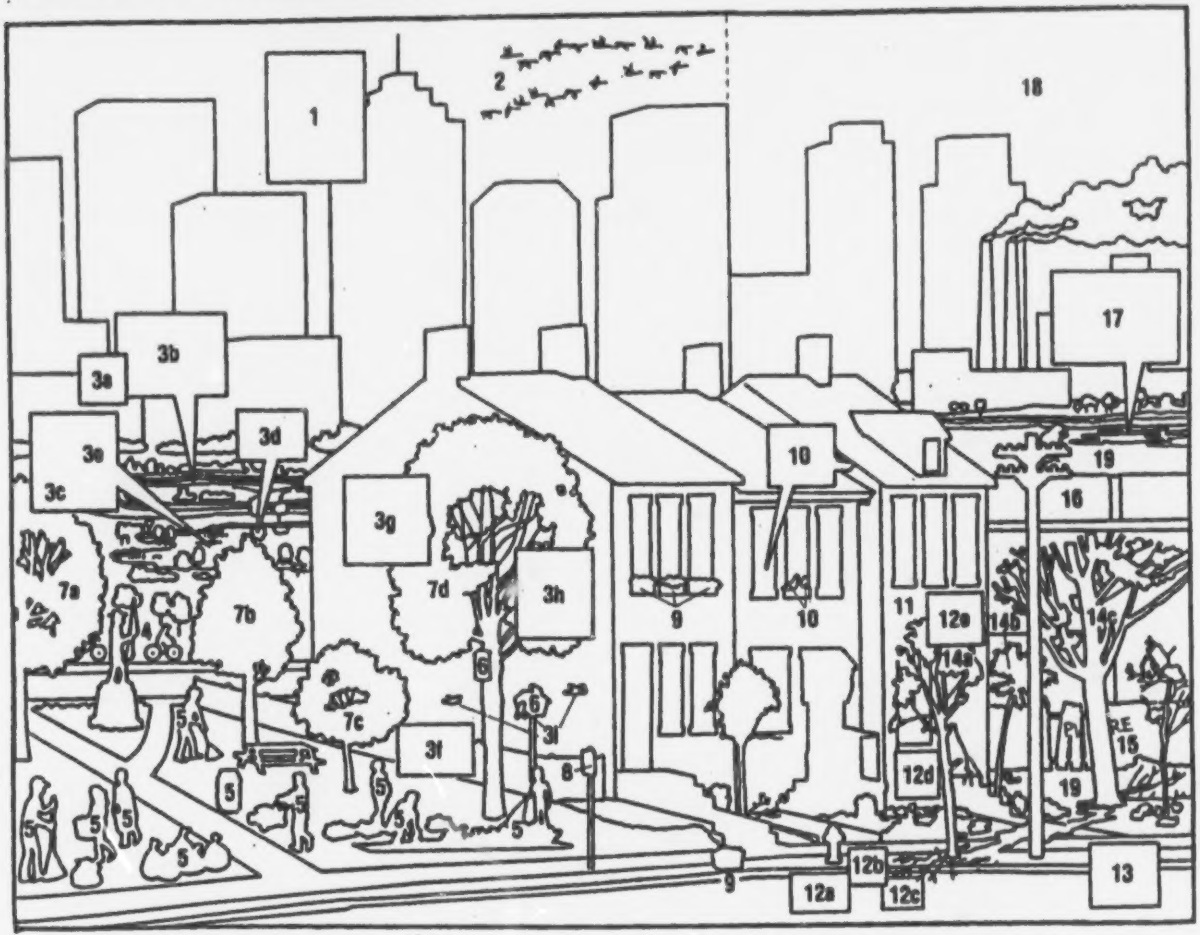


RURAL POSTER



1. Home well shaded
2. Diversity of wildlife species
    - a. Great-horned owl
    - b. Wild turkey
    - c. White-tailed deer
    - d. Downy woodpecker
    - e. Barn swallow
    - f. Goldfinch
    - g. Chickadee
    - h. Belted kingfisher
    - i. Cedar waxwing
    - j. Robin
    - k. Killdeer
    - l. Water snake
    - m. Ring-necked pheasant
    - n. Deer mouse
    - o. Mourning cloak butterfly
    - p. Red admiral butterfly
    - q. Dragonfly
    - r. Smallmouth bass
    - s. Johnny darter
    - t. Fathead minnow
    - u. Painted turtle
    - v. Yellow swallowtail butterfly
    - w. Chipmunk
3. Diversity of plant species
    - a. Purple trillium
    - b. Wild geranium
    - c. Marsh marigold
    - d. Violets
4. Turkey hunter
5. Timber harvest (stump)
6. Seedling regeneration
7. Bluebird house
8. Dead standing tree
9. In stream aquatic habitat
10. Conservation tillage practice
11. Vegetative border along stream
12. Exotic species, honeysuckle, affecting tree
13. Tire producing mosquito breeding site
14. Trees felled by overpopulation of beaver
15. Trash in stream
16. "Trash" species of fish
    - a. Carp
    - b. Goldfish
17. Abundance of algae in stream due to fertilizer run-off
18. Lack of vegetation resulting in severe erosion along stream
19. Rills and gullies from agricultural field
20. Starling
21. Dead fish
22. Purple loosestrife, exotic plant
23. Destruction of "No Trespassing" sign
24. Discharge into wetland
25. Off-road vehicle tearing up soil
26. Fence torn out
27. Cattle grazing in timber
28. Browse line in timber
29. Stag-headed tree
30. Sign nailed into tree
31. Lack of vegetation around homes

URBAN POSTER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5
5
5
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5
RE
15
19
12d
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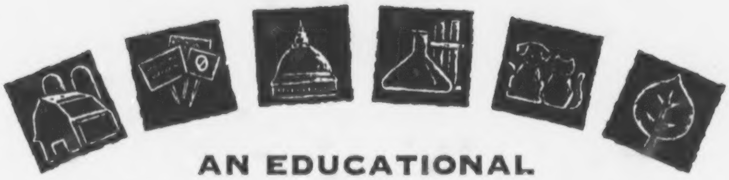
12b
12a
12c
9

1. Peregrine falcon nesting on high rise building
2. Giant Canada geese
3. Diversity of wildlife species
    - a. Leopard frog
    - b. Fish
    - c. Mallard
    - d. Raccoon
    - e. Yellow-headed blackbird
    - f. Question mark butterfly
    - g. Fox squirrel
    - h. Cardinal
    - i. Goldfinches at feeder
4. Bike trail
5. Community park and gardens (rake and recycle leaves, cutting grass, trash receptacle, planting and watering flowers)
6. Bird feeder, bird nest house
7. Diversity of plant species
    - a. Ash tree
    - b. Pin oak tree
    - c. Dogwood tree
    - d. Maple tree
8. Bus stop sign
9. Window boxes, recycling bin
10. Rock doves (pigeons) roosting on homes and on ledges
11. Home in disrepair
12. Undesirable animals
    - a. Norway rat
    - b. Cockroach
    - c. House mouse
    - d. House sparrow
    - e. Starlings
13. Litter
14. Undesirable and unkempt tree species
    - a. Chinese elm
    - b. Tree-of-heaven
    - c. Cropped tree under powerline
15. Graffiti
16. Mass transit
17. Filling wetland
18. Air pollution
19. Lack of vegetation

PEOPLE~ANIMALS
AND THE ENVIRONMENT



AN EDUCATIONAL
Simulation Game

PEOPLE~ANIMAL
AND THE ENVIRONME

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PEOPLE ~ ANIMALS AND THE ENVIRONMENT

AN EDUCATIONAL

Simulation Game

TEACHERS GUIDE

Teacher's Guide/Introduction

The purpose of this resource is to examine the relationship between humans and animals, and to explore the roles that animals play in our daily lives. Underlying the issues associated with animal use are several questions. How do we see ourselves and our relationship to nature? What is the appropriate relationship of each species to the others? Do all living things have rights? Where do rights come from, and how are they conferred? What is the relationship between rights and responsibilities? Of what importance is animal use in our society?

To help students address these questions, "People, Animals and the Environment" uses the technique of social simulation, modeled on the behavior of real citizens in a democratic society. The simulation is intended to acquaint students with the diverse actions, motives, perceptions and decision-making skills which human beings bring to the political process and the development of public policy on complex, often controversial issues.

In the past few years, many differing views have been expressed on the use of animals in our society. Some people believe that animals have rights as "sentient beings" in the same way that humans have rights, so they may not be used for any purpose. Others believe that animals may be used for human benefit as long as they are treated humanely. Some feel that all animals, including pets, are enslaved by humanity's needs. Others endorse pet ownership but refuse to eat meat or drink milk. This resource will help students formulate their own opinions as well as respect the opinions of others.

Increasingly, school curricula are focusing on environmental matters, conservation and the wise use of global resources. High-profile celebrities have affiliated with causes ranging from saving the whales to rainforest conservation. As a result, students are more frequently being challenged to formulate positions on the environmental, economic and ethical issues associated with humanity's use of animals. This resource has been designed to explore these crucial themes.

The simulation game teaching technique employed in "People, Animals and the Environment" is a student-centered process in which students are given the opportunity to learn and to communicate their ideas and knowledge in an exciting and stimulating exercise. Working cooperatively in small groups, the participants will develop research, oral and written communication skills. They also will be encouraged to listen critically to diverse views in an effort to promote open-minded tolerance for the opinions of others.

ILLINOIS STATE GOALS FOR LEARNING CURRICULUM OBJECTIVES/ LEARNER OUTCOMES

This teaching resource is appropriate for integration into social sciences, biological/physical sciences or language arts curricula. **It has been designed to produce specific learner outcomes consistent with Illinois State Goals for Learning in each of these three curriculum fields:**

Social Sciences

GOAL 1: Students will be able to understand and analyze comparative political and economic systems, with an emphasis on the political and economic systems of the United States.

- Students will understand the influence of political action by individuals and interest groups on the development of the American political system.
- Students will understand the role that animal use industries have played in the economic development of the United States.
- Students will understand the economic impacts of political decisions made by the U.S. Congress.
- Students will understand the effects of basic economic principles on producers and consumers in the public and private sectors.

GOAL 2: Students will be able to understand and analyze events, trends, personalities and movements shaping the history of the world, the United States and Illinois.

- Students will understand the impacts of urbanization, industrialization and emerging technology on the nation's environment, as well as on its social, political and economic institutions.

GOAL 3: Students will be able to demonstrate a knowledge of the basic concepts of the social sciences and how these help to interpret human behavior.

- Students will understand selected types of antisocial behavior and various methods of intervention.
- Students will understand the influences of customs, traditions and folkways in shaping human behavior.
- Students will understand the effects of mass communication on human behavior and society.

GOAL 4: Students will be able to demonstrate a knowledge of world geography with emphasis on the United States.

- Students will understand ways in which people define, name and alter places.
- Students will understand different ways in which various groups within society may view places.
- Students will understand positive and negative effects of human actions or natural processes on places.
- Students will understand ways people inhabit, modify and adapt culturally to different physical environments.
- Students will understand ways in which habitats as complex ecosystems have been modified by human action.
- Students will understand ways in which people use natural environments to extract needed resources, grow crops and develop settlements.
- Students will understand ways in which people depend on products that come from beyond their immediate environment.

GOAL 5: Students will be able to apply the skills and knowledge gained in the social sciences to decision-making in life situations.

- Students will be able to apply rational decision-making processes based on goals, values and needs to selected consumer and social problems (i.e., problems associated with animal use).
- Students will be able to evaluate sources of information based on selective criteria.
- Students will be able to evaluate the costs and benefits of a particular course of action.
- Students will understand their interdependent roles as consumers, producers and citizens of the United States.
- Students will understand the role of individuals and/or groups in affecting change.
- Students will understand the relationships between individual and societal value systems.
- Students will be able to evaluate strategies for conflict resolution based on selected criteria.
- Students will be able to manage human and material resources.

Biological/Physical Sciences

GOAL 1: Students will have a working knowledge of the concepts and basic vocabulary of biological, physical and environmental sciences, and their application to life and work in contemporary technological society.

- Students will understand symmetries or patterns in the natural world.
- Students will understand orderliness in nature and the schemes we use to express this order.
- Students will understand how two or more things interact and the effect each has on the other.
- Students will understand common characteristics of plant and animal communities.
- Students will understand characteristics of energy and matter.
- Students will understand the concept of equilibrium applied to simple systems.
- Students will understand the role of perception as our way of interpreting the world.

GOAL 2: Students will have a working knowledge of the social and environmental implications and limitations of technological development.

- Students will understand the relationships between science and technology.
- Students will understand the difference between renewable and non-renewable resources.
- Students will understand relationships between the natural and technological world.
- Students will understand the influence of scientific and technological research on the needs, interest and financial support of society.
- Students will be able to apply the findings of scientific research to consumer decision making.
- Students will be able to apply selected ecological concepts to human and environmental situations.
- Students will understand society's responsibility for improving the environment and conserving natural resources.
- Students will be able to evaluate environmental issues in light of scientific and technological knowledge and ethical principles.

GOAL 3: Students will have a working knowledge of the principles of scientific research and their application in simple research projects.

- Students will understand the rights of subjects, humanness and respect for life.

Language Arts

GOAL 1: Students will be able to read, comprehend, interpret, evaluate and use written material.

- Students will be able to recognize, recall and summarize material read.
- Students will be able to question and predict, giving rationales for each prior to, during and after reading.
- Students will be able to read for various purposes and identify text to accomplish each purpose.
- Students will demonstrate sensitivity to difficulties of the text, requirements of the task, abilities and motivation.
- Students will be able to use appropriate inferences to achieve a full understanding of the text.
- Students will be able to integrate information from more than one text.
- Students will be able to justify and explain answers to questions about material read.

GOAL 2: Students will be able to listen critically and analytically.

- Students will understand the meaning of spoken messages.
- Students will be able to identify a sequence of ideas from spoken messages.
- Students will be able to derive inferences from spoken messages and nonverbal cues.
- Students will be able to distinguish among different purposes in communication.
- Students will understand and respect differing perspectives and points of view.
- Students will be able to demonstrate effective and appropriate responses.

GOAL 3: Students will be able to write standard English in a grammatical, well-organized and coherent manner for a variety of purposes.

- Students will be able to use appropriate language and style in writing for a variety of purposes and audiences.
- Students will be able to develop and maintain a focus with a clear thesis, a main idea, theme or unifying event.
- Students will be able to use specific information or reasons to support or elaborate the main point.

- Students will demonstrate clear, coherent, logical organization of ideas within the appropriate major discourse structures.
- Students will be able to use standard written English conventions.
- Students will be able to revise, edit and proofread.

GOAL 4: Students will be able to use spoken language effectively in formal and informal situations to communicate ideas and information, and to ask and answer questions.
- Students will speak clearly and expressively.
- Students will be able to present ideas in an orderly manner with appropriate introduction, elaboration and conclusion.
- Students will be able to develop ideas with appropriate support materials.
- Students will be able to use appropriate language and nonverbal cues for the topic, audience and setting.
- Students will be able to use language for a variety of purposes.

THE SIMULATION GAME

The simulation game is a well-known teaching technique, specific forms of which may vary according to their structure and purpose. Some feature physical simulations, such as those used to test airplane prototypes and train pilots.

Others, including this one, feature role-playing. Role-playing encourages the development of critical thinking skills, as students are sometimes asked to advocate for positions with which they may find themselves in disagreement.

The Structure of the Game

"People, Animals and the Environment" takes the form of a Congressional hearing on the topic of animal use in the United States. A Congressional Committee has been formed to examine the use of animals for food, clothing, biomedical research, entertainment and companionship. The Committee will explore the economic, environmental and ethical issues associated with animal use, and advise the U.S. Congress about specific actions which should be taken to promote, regulate or restrict animal use.

The Committee is directed to hold public hearings at which oral presentations will be made by a number of groups with a direct interest in the topic. These groups will also submit written testimony to the Committee. The Committee will prepare both oral and written final reports.

Depending on the size of the class, the Congressional Committee may have either three or five members, including a chair elected by the group or appointed by the teacher. Each of the interest groups should have approximately the same number of individuals.

Game Materials

1 Teachers Guide
6 Student Guides
7 Sets of Color-Coded Role and Data Cards
  a. (All Groups/Yellow)
  b. (Congressional Committee—Dark Blue)
  c. (Association for Animal Rights—Red)
  d. (Conservation Society of America—Green)
  e. (American Animal Agriculture Association—Purple)
  f. (Americans for Medical Advances—Orange)
  g. (People and Animals in Partnership—Light Blue)

All groups will receive both role and data cards. Role cards will provide specific information about the values and attitudes of the interest group to which the student has been assigned. Data cards will provide background information, including both factual and interpretive material that will be useful in their role-playing. Each group will receive the materials labeled "All Groups" to help provide a common frame of reference as the discussion begins.

Students are not limited to the information provided on role and data cards. They should be encouraged to seek out additional information and ideas with which to build their positions. A list of additional sources of information is included with this game. After thorough research and preparation, each interest group will make oral and written presentations. Then the Committee will retire to produce its Final Report. The Final Report will serve as the basis for summation and discussion to be led by the teacher at the conclusion of the game.

MANAGING THE SIMULATION GAME

"People, Animals and the Environment" has been designed for delivery over 10-11 class periods of 45-50 minutes each. The success of the game depends on the teacher's ability to communicate enthusiasm and manage the logistics of the game. In order for the simulation to be successful, students must be active participants. The teacher's challenge is to walk the fine line between involvement and detachment — to remain involved enough to assure that the sense of reality is preserved, while remaining detached enough to avoid distorting the dynamics of the game.

Suggested Time Lines

PERIOD 1: Introduction of Game
Explanation of Rules
Assignment of Roles
Homework: Study Information
PERIOD 2: Student Group Work - 1
- Congressional Committee meets,

	reviews mandate and background information ■ Interest Groups meet individually, review background information and plan oral and written submissions.
PERIOD 3:	Student Group Work - 2 ■ Committee meets on economic issues ■ Interest Groups meet to develop their economic arguments
PERIOD 4:	Student Group Work - 3 ■ Committee meets on environmental issues ■ Interest Groups meet to develop their environmental arguments
PERIOD 5:	Student Group Work - 4 ■ Committee meets on ethical issues ■ Interest Groups meet to develop their ethical arguments
PERIODS 6-8:	Congressional Committee Hearings/oral testimony
PERIOD 9:	■ Interest Groups submit written briefs ■ Congressional Committee prepares oral and written reports
PERIOD 10:	■ Congressional Committee presents oral report ■ Congressional Committee submits written report
PERIOD 11: **(OR 10-11)**	Teacher-Student Summary and Debriefing Session

The Committee Hearings

It is important to maintain procedural fairness during the Committee hearings. Time constraints proposed here are based on the assumption that two groups will make their presentations each period, assuming a 45-50 minute period. If time and interest permit, the hearings could easily be expanded. It is suggested that each interest group be permitted ten minutes for an oral presentation by one or more spokespersons. Then each member of the Congressional Committee will be permitted four minutes for questions.

Each interest group must submit a written brief to the Committee in addition to their oral presentation. The brief will be required at the first period following the oral presentations to permit revisions, if desired, in light of the arguments put forth in other presentations.

The simulation game has been designed to encourage expression of many views, so students should be permitted considerable flexibility in the way they structure their presentations. Although the mandate of the Congressional Committee is to examine the economic, environmental and ethical aspects of animal use, it is not necessary that each group address each aspect of the issue with the same intensity. Some group or groups may choose to emphasize one or two issues which best support their position, and place less emphasis on others.

It should be noted, however, that most groups will be expected to answer questions on all aspects of the issue when making their presentations before the Congressional Committee. Too narrow a focus could impair the ability of the group to respond effectively to questions, or to refute arguments raised by other groups.

Students in the interest groups and members of the Congressional Committee must be true to their roles. While students in each interest group should be expected to display excellence in research skills, debating techniques, psychological judgment, political tactics and persuasion, members of the Congressional Committee will be expected to show expertise in a particular field; integrity in their personal character; and fairness and open-mindedness in their willingness to listen to and judge impartially the merits of the positions being presented to them.

EVALUATION METHODS

Many educators who have used simulation games recommend against grading students at all, because of the difficulty in arriving at a clear standard of performance. If the apparent goal of the interest groups is to influence the Committee, how can we tell if they have accomplished this? Perhaps the Committee's report simply reflected their prior prejudices. Another complicating factor is the difficulty in accurately assessing the levels of performance associated with different roles. In addition, it may be difficult to compare the contribution of the spokesperson of a group with that of the other members.

There are, however, some options which may be suggested:

a) Group Work Evaluation
b) Research Note Evaluation
c) Oral Presentation Evaluation
d) Written Presentation Evaluation
e) Peer-Evaluation
f) Self-Evaluation

Forms which may be used as presented or amended to suit the individual teacher's needs are included in this Teacher's Guide.

EVALUATION FORM
APPENDIX A

Evaluation During Group Work

Group Name ____________________

Group Members ____________________

____

A mark may be assigned for the following aspects of a student's group work:

1. Topic understanding ____________________
2. Task focus ____________________
3. Load sharing ____________________
4. Discussion quality ____________________
5. Organization ____________________
6. Ability to work with others ____________________
7. Depth of research ____________________
8. Group effort ____________________
9. Group cohesion ____________________
10. Completion of task ____________________

Total mark for this aspect of the simulation ____________________

Student name ____________________
(evaluator)

PEOPLE~ANIMALS AND THE ENVIRONMENT

EVALUATION FORM
APPENDIX A

Evaluation of Research Notes

Group Name ____________________

Group Member's Name ____________________

Intermediate Evaluation ____________ Date ____________

Final Evaluation ____________ Date ____________

1. Do research notes contain reasonable detail?

2. Are sources of notes recorded?

3. Has a reasonable amount of research been done to this point in time?

Final mark for this aspect of the simulation ____________________

EVALUATION FORM
APPENDIX A

Evaluation of Oral Presentation

Group Name____

Group Member's Name__________________________________

A mark may be assigned for the following aspects of a student's oral presentation:

1. General impression ____________________
2. Ability to represent role played ____________________
3. Interest built up in audience ____________________
4. Ability to communicate ____________________
5. Clarity of presentation ____________________
6. Performance during question/answer period ____________________
7. Depth of understanding ____________________
8. Organization ____________________
9. Group unity ____________________
10. Time, tone, control ____________________

Total mark for this aspect of simulation ____________________________

Student name ____
(Evaluator)

EVALUATION FORM
APPENDIX A

Evaluation of Written Report

Group Name____

Group Member's Name____________________________________

PRESENTATION: Were the ideas in the report presented in a clearly organized fashion?

CONTENT: Was the information presented of interest? Was the information supported by textual proof? Did the writer present important points or merely superficial ones?

STYLE: Was the student's level of expression appropriate to the subject matter? Were punctuation/spelling acceptable? Were paragraphs effectively organized?

GENERAL COMMENTS:

Mark for this aspect of the simulation________________________________

EVALUATION FORM
APPENDIX A

Peer Evaluation of Overall Work

Group Name________________________________

Group Member's Name________________________________

1. Did he/she work effectively with the group?

2. What have I learned about this group member from the simulation process?

3. The greatest strength of his/her presentation was:

4. The greatest shortcoming, if any, of his/her participation was:

5. Suggestions for improvement of the group member being evaluated for future projects of this type are:

6. The mark I give to this group member for his/her contribution is:

7. My name is ________________________________
(evaluator)

EVALUATION FORM
APPENDIX A

Self Evaluation

Group Name____

Group Member's Name____

1. Did I work effectively and make important contributions to my group? Give examples.

2. The greatest strength of my participation in the simulation was:

3. The greatest weakness of my participation in the simulation was:

4. What knowledge have I gained about animal use in the U.S.?

5. In what ways have my attitudes toward animal use changed as a result of participation in this simulation?

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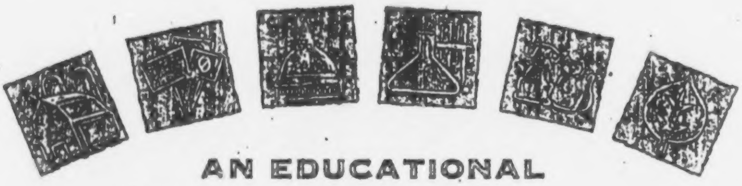
PEOPLE ~ ANIMALS
AND THE ENVIRONMENT



AN EDUCATIONAL
Simulation Game

STUDENT GUIDE

PEOPLE ~ ANIMAL
AND THE ENVIRONME

PEOPLE~ANIMALS
AND THE ENVIRONMENT

Student Guide/Introduction

In the past few years, many different views have been expressed on the topic of animals and the uses people make of them. What is our relationship to animals? Do animals have rights? Where do rights come from? What responsibilities do we have as humans to animals and the environment? Should animals be eaten for food? Should they be used for clothing? Should they be used for medical research, or kept in zoos or as household pets?

Those who believe in animal rights believe it is wrong for humans to use animals for any purpose — food, clothing, medical research, entertainment or companionship.

Others believe it is acceptable for humans to use animals as long as we do so humanely and responsibly.

The debate about animal use goes to the very nature of the relationships among species. There are no clear answers that will appeal to everyone. What this resource will do, with your participation, is to help clarify the questions.

As you think about these issues, you will need to see them in the larger context of humanity's place in nature. There are economic, environmental and ethical considerations which will influence society's decisions about animal use. You will be asked to address these questions:

1. What are the economic issues associated with animal use? How important is animal use to our American economy? What effect would eliminating animal industries have on affected workers and businesses? What effect would it have on consumers?

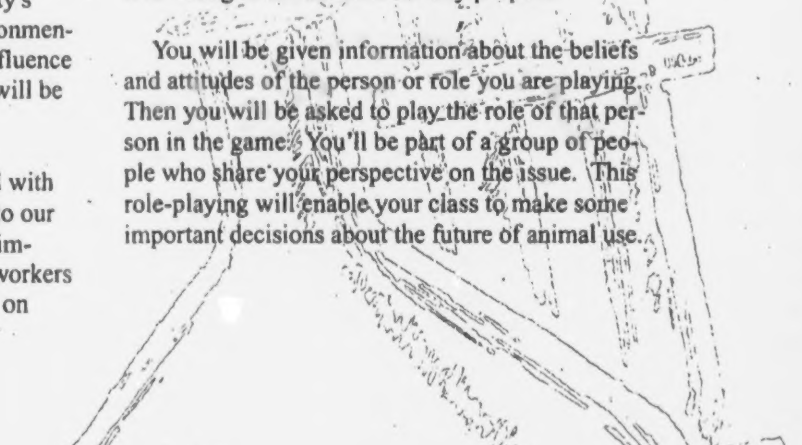
2. What are the environmental issues associated with animal use? How does our use of animals impact on the environment? Does animal use contribute positively to conservation, or does it threaten the balance of nature?

3. What are the ethical questions associated with animal use? Does our daily treatment of animals meet ethical standards of humane treatment? How should "humane treatment" be defined and by whom?

This resource is designed as a "simulation game." Although we call it a game, it has a serious purpose. As you participate in the game, you will see that different people have very different views on all these questions. Your job is to form your own opinions. Remember that, like you, your classmates sincerely believe that they are right. You will have to listen carefully to all viewpoints and sort through them to reach a balanced decision.

As part of the game, you will play the role of a person who may not be very much like you at all. You may be asked to play the role of a member of Congress investigating animal use, or a farmer who raises animals for a living. You may be asked to play the role of a scientist interested in animal research, or an animal rights activist who believes it is wrong to use animals for any purpose.

You will be given information about the beliefs and attitudes of the person or role you are playing. Then you will be asked to play the role of that person in the game. You'll be part of a group of people who share your perspective on the issue. This role-playing will enable your class to make some important decisions about the future of animal use.



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PEOPLE~ANIMALS AND THE ENVIRONMENT

RULES OF THE GAME

The game begins with the creation of a special Congressional Committee to examine various aspects of animal use in the United States. The Committee's job is to conduct public hearings, and to listen to a variety of groups with different views on the subject. After the Committee has heard all the arguments and the evidence of various groups, it will make a report containing recommendations for future action.

RESPONSIBILITY OF THE CONGRESSIONAL COMMITTEE

The Committee will consider three specific topics as it works to recommend an official policy on animal use. It will examine the economic, environmental and ethical issues associated with animal use, posing questions such as:

1. How important are animal industries to the U.S. economy? Should the government try to support and expand those industries? Should it help them seek foreign markets? Should it try to restrict some animal industries and persuade workers to seek other livelihoods?

2. How does animal use affect our environment? Should the government support conservation efforts? Should it encourage industries to regulate themselves, or should it impose additional restrictions on them?

3. What are the ethical questions associated with animal use? Should the government enact stricter controls on the way animals are managed, or should it encourage animal industries to develop their own standards? Should government support the use of animals for food, clothing and medical research, or should it try to outlaw these animal uses?

Congressional Committee members must first familiarize themselves with the description of their role and read the background material that has been prepared for them. Then they must meet to consider what kinds of questions they will ask of the special interest groups that will be making presentations before them.

Secondly, the Committee will conduct the public hearings. They will listen attentively as each group makes its oral presentation. Then they will question members of each group about animal use, basing their queries upon the information presented by the group as well as on additional background research the committee might have done. At the end of the hearings, the Committee will receive from each group a written brief or summary of the facts presented and points made by that group to assist the Committee in preparing its final report.

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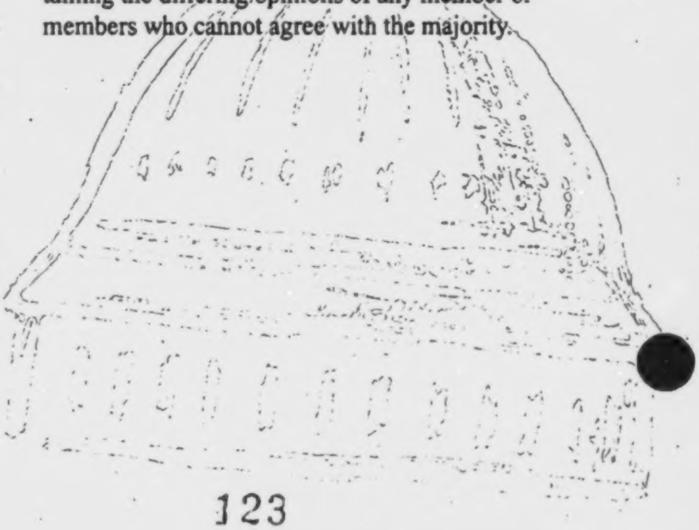

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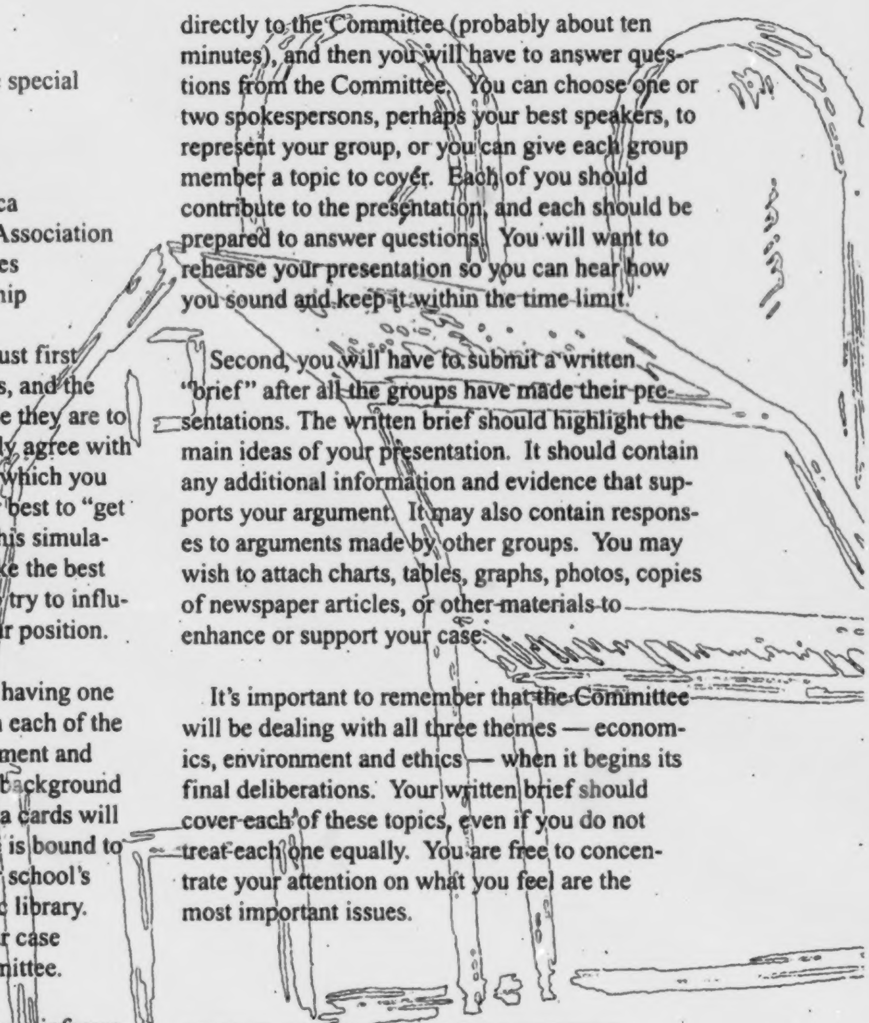

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3. Where do "rights" come from?
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1. What industries in the U.S. make use of animals?
2. How many people are employed in animal-related industries in the U.S.?
3. In what parts of the U.S. do they live?
4. What is the economic value of animals and animal products in the U.S.?
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7. What would be the cost or benefits of eliminating all meat consumption and adhering strictly to a vegetarian diet?
8. What would happen to workers in animal industries and their communities if all animal use were to be stopped?
9. Who are the main customers for animal byproducts in the U.S.?

Environmental Issues

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PEOPLE ~ ANIMALS
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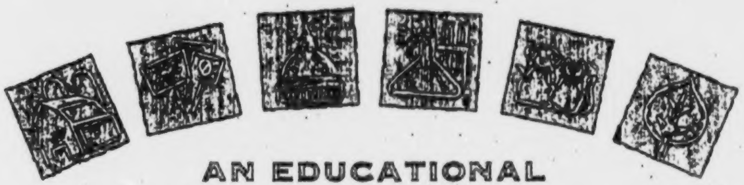

AN EDUCATIONAL
Simulation Game

STUDENT GUIDE

PEOPLE ~ ANIMA
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The debate about animal use goes to the very nature of the relationships among species. There are no clear answers that will appeal to everyone. What this resource will do, with your participation, is to help clarify the questions.

As you think about these issues, you will need to see them in the larger context of humanity's place in nature. There are economic, environmental and ethical considerations which will influence society's decisions about animal use. You will be asked to address these questions:

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RULES OF THE GAME

The game begins with the creation of a special Congressional Committee to examine various aspects of animal use in the United States. The Committee's job is to conduct public hearings, and to listen to a variety of groups with different views on the subject. After the Committee has heard all the arguments and the evidence of various groups, it will make a report containing recommendations for future action.

RESPONSIBILITY OF THE CONGRESSIONAL COMMITTEE

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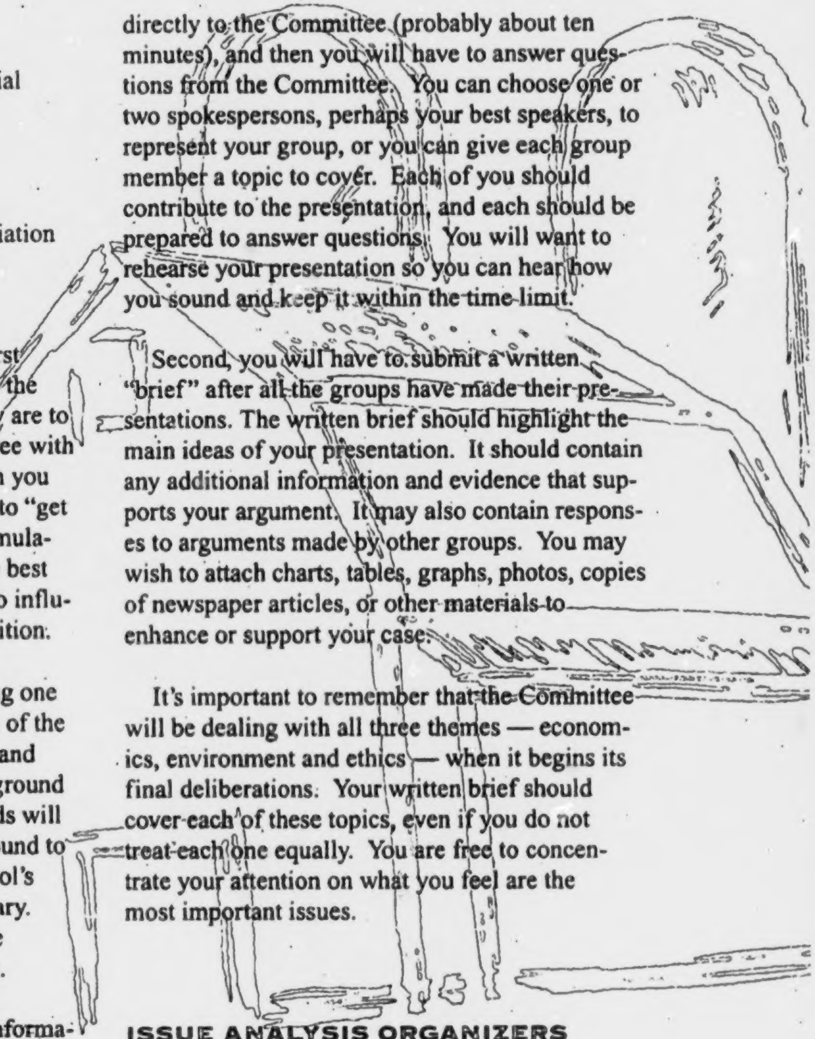

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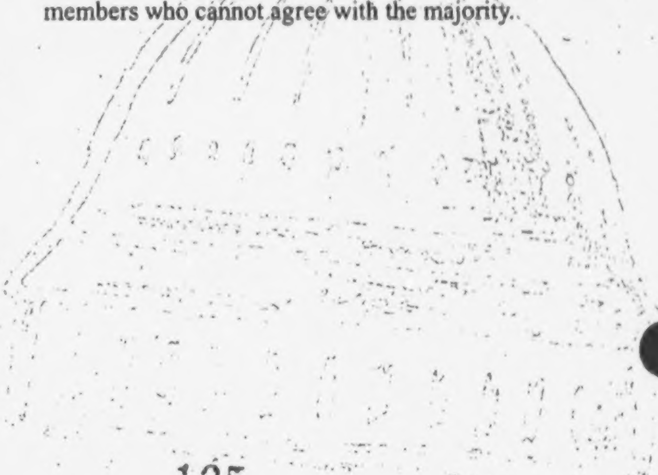

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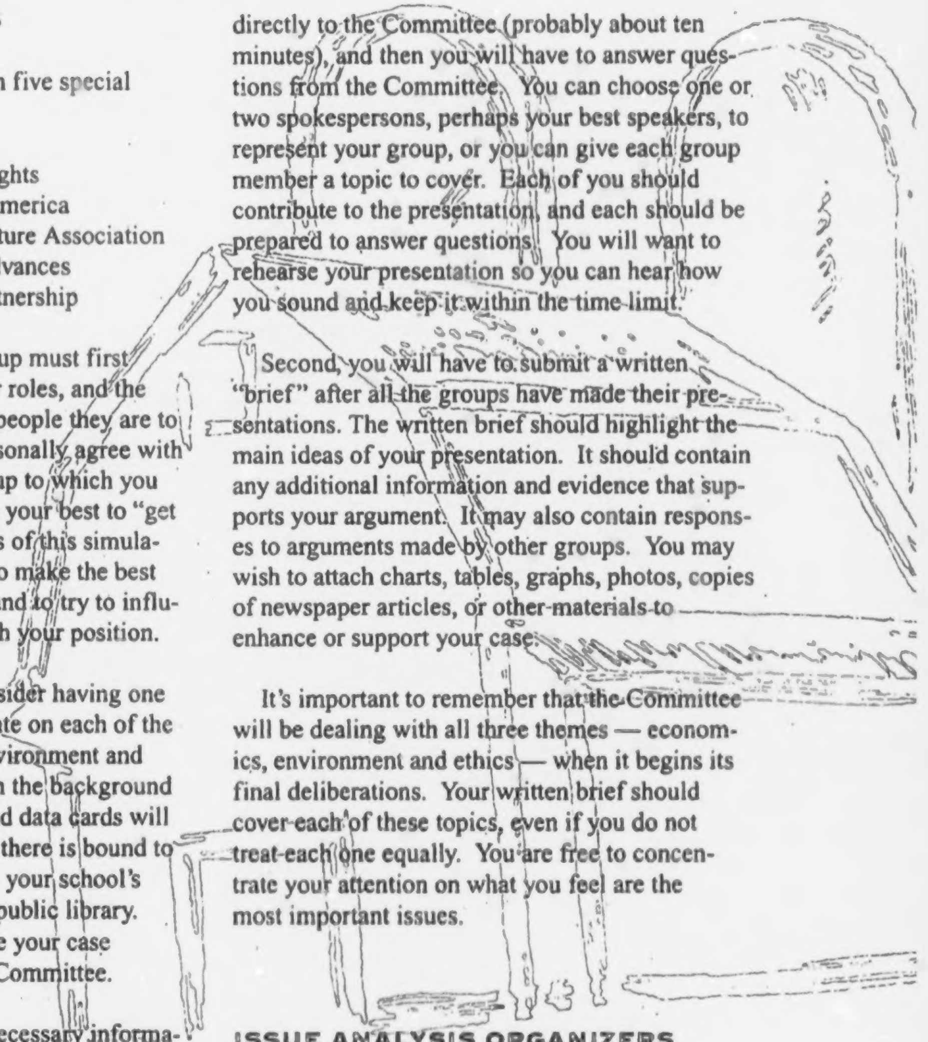

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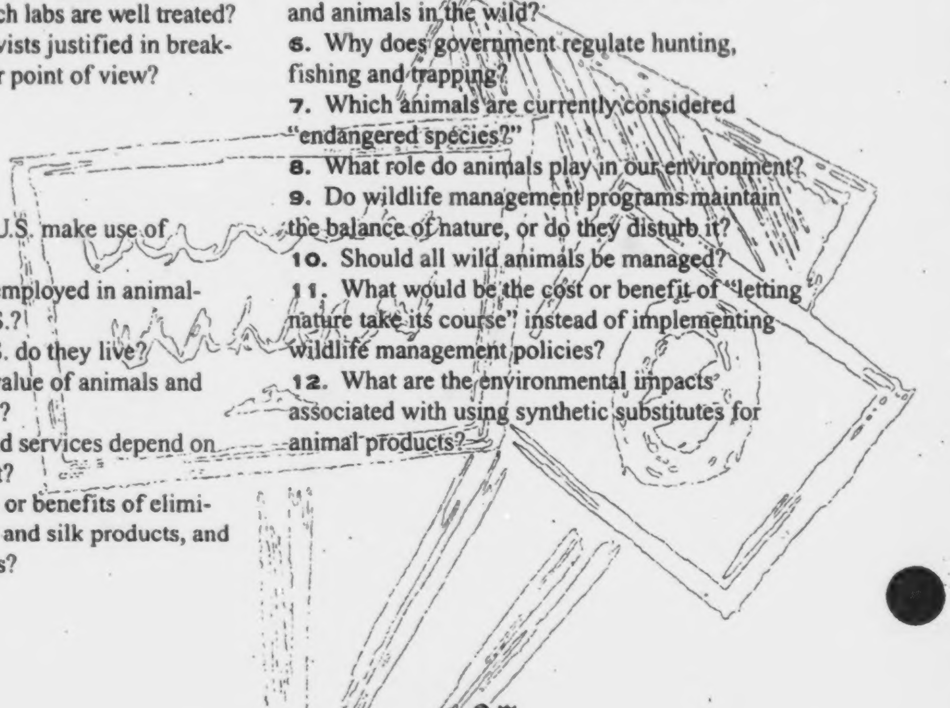

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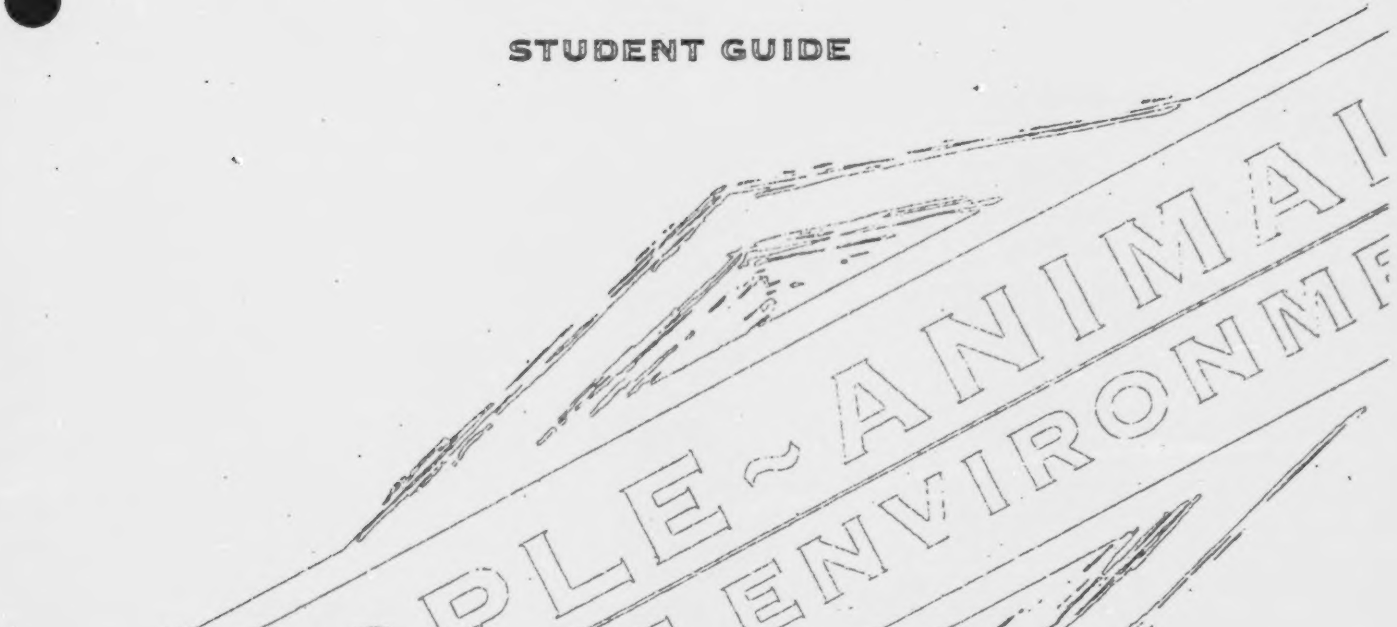
STUDENT GUIDE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2. How does animal use affect our environment? Should the government support conservation efforts? Should it encourage industries to regulate themselves, or should it impose additional restrictions on them?

3. What are the ethical questions associated with animal use? Should the government enact stricter controls on the way animals are managed, or should it encourage animal industries to develop their own standards? Should government support the use of animals for food, clothing and medical research, or should it try to outlaw these animal uses?

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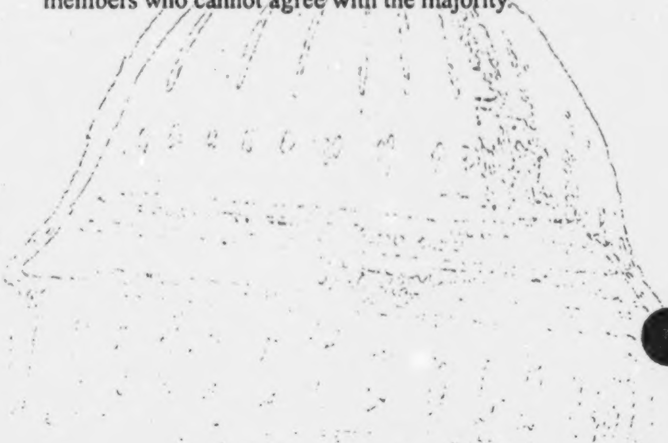

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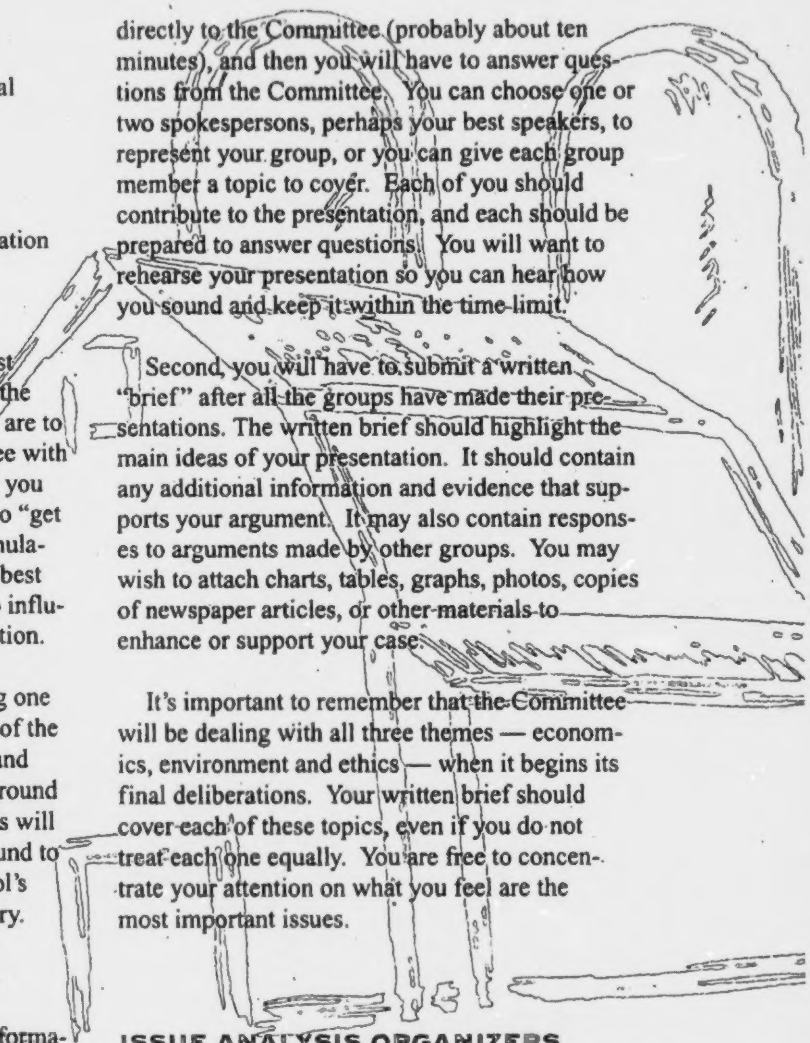

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PEOPLE~ANIMALS AND THE ENVIRONMENT

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3. Where do "rights" come from?
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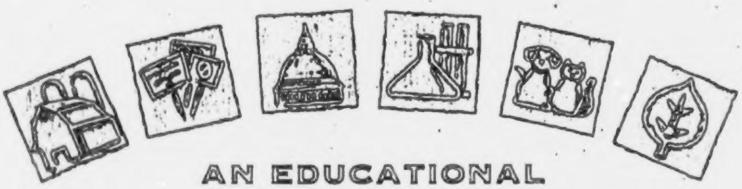

AN EDUCATIONAL

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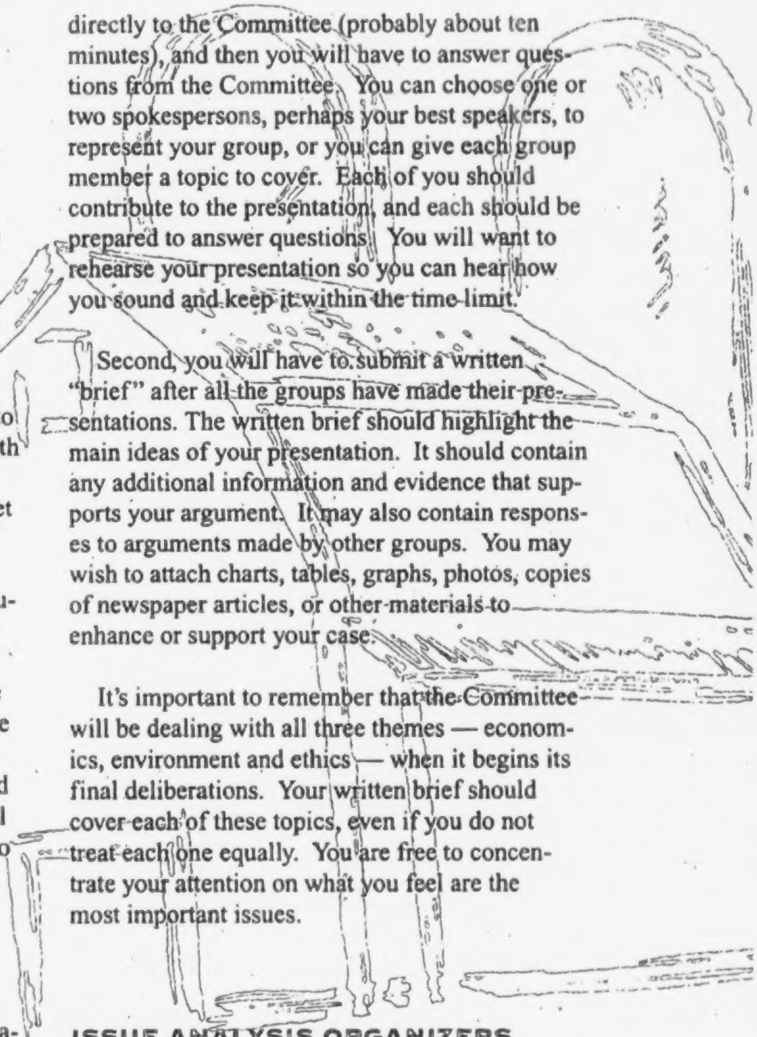

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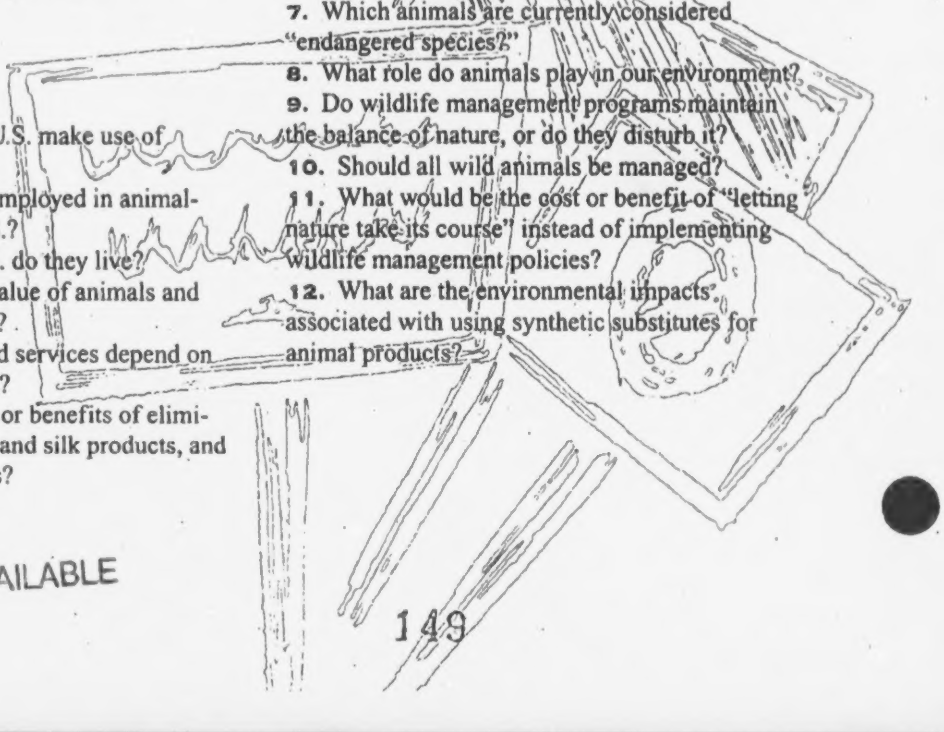

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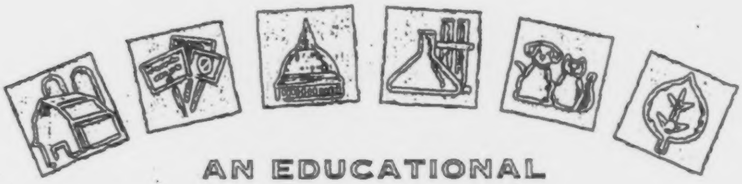

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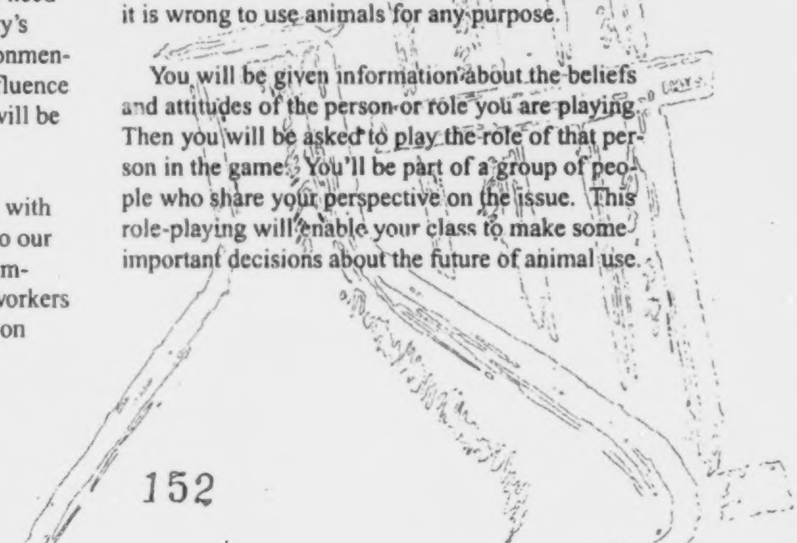

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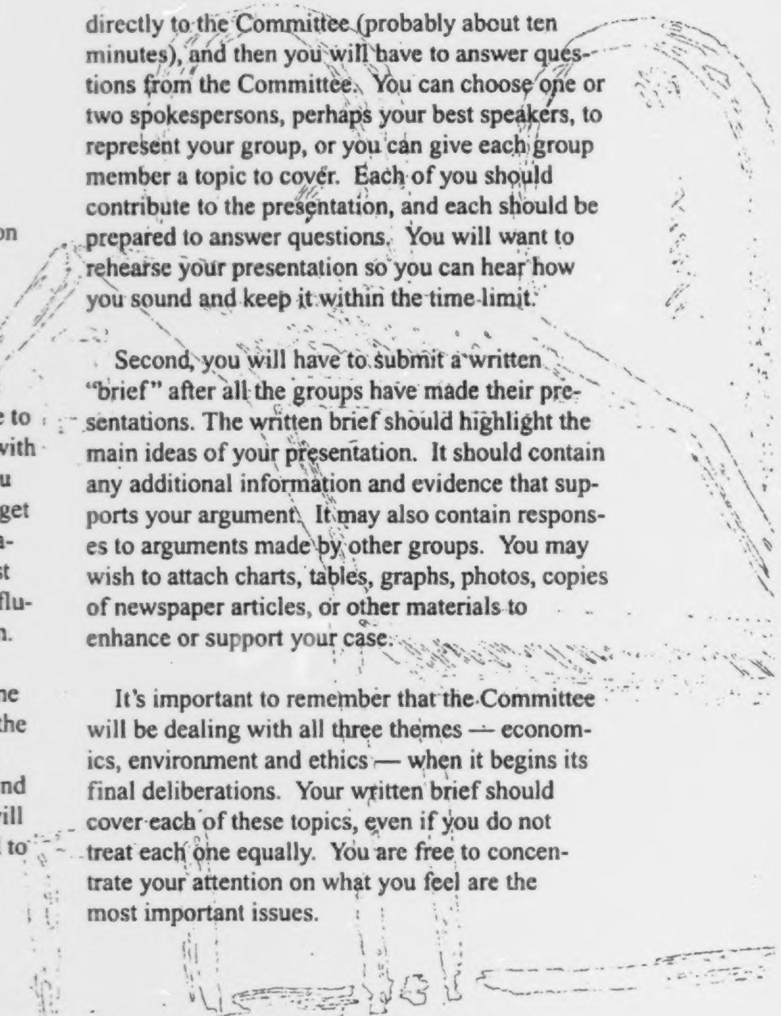

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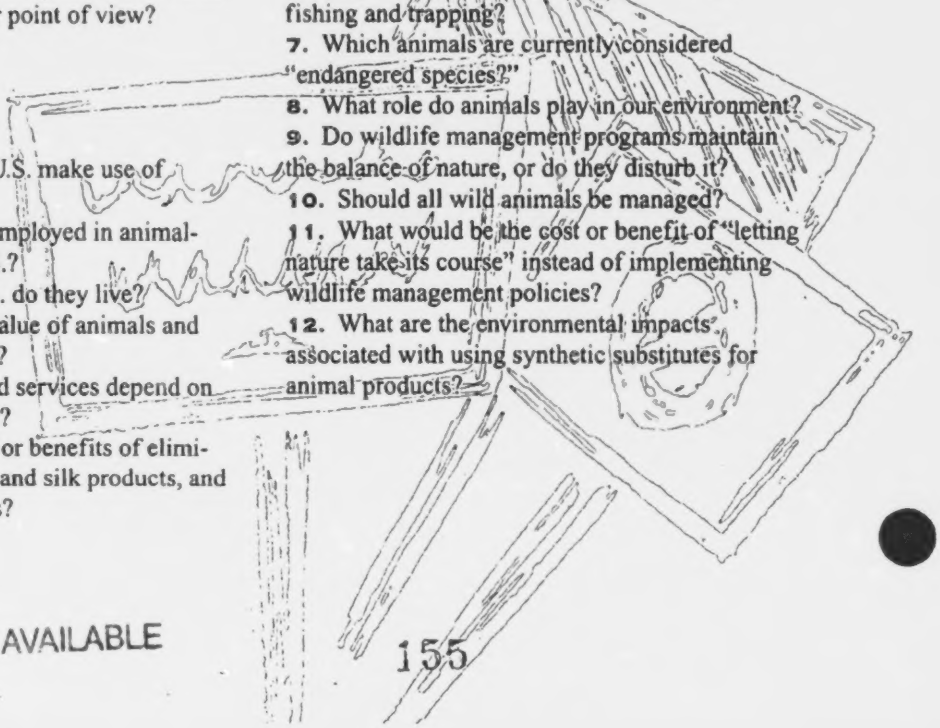

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A-1 AN ETHIC OF RESPECT

Our society has become highly sophisticated in its use of modern science and technologies to improve everything from lifespan to lifestyles. Yet despite all this modern technology, we remain dependent on nature for our own ultimate survival.

Our dependence on nature has led to a recognition that, if we are to continue to benefit from its bounty, we must be careful not to destroy its life-giving processes. This concept is an important principle of the conservation ethic. The main idea is that our "taking" must be balanced by "giving back." We can give back to nature simply by demonstrating respect for it. Our respect for nature occurs at various levels:

1. Respect for Land: Habitat is the key to the survival of all things. License fees paid by people who enjoy camping, hunting, fishing and trapping help offset the cost of government conservation and habitat development programs, which would otherwise have to be paid for entirely by taxpayers. Without this economic support, it would become too expensive to conserve and develop habitat on government lands. In certain areas, this would result in loss of habitat to development or to ecological changes left unaddressed.

2. Respect for Species: International, federal and state laws regulate the harvesting of species to assure that none becomes threatened or endangered because of mismanagement of our natural resources. These regulations are based on scientific information from government biologists, natural scientists and wildlife managers, who conduct highly technical research and observation in order to gather the data necessary to formulate sound wildlife management policy.

3. Respect for Animals: Society's use of animals for human benefit brings with it a responsibility to assure that those animals are treated humanely. Government, industry and private citizens have worked together to develop laws and regulations to assure responsible treatment of animals in agriculture, medical research, the pet industry and other fields.

4. Respect for Cultures: Although American society has become highly urbanized, there are still regions of the U.S. where entire cultures and economies rely on the use of animals and the natural environment. Native communities in Alaska, for example, have long depended on the seal as a source of food, clothing and revenue. Although this lifestyle may seem strange to urban dwellers, it is important for us to recognize and show respect for cultures whose customs are different from our own.

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A-2 THE WEB OF LIFE

All living creatures on this planet are ultimately dependent on one another for survival. Although the relationships between widely diverse species may not seem immediately apparent, a closer look at our ecology readily reveals these links.

All organisms, dead or alive, are potential sources of food energy for other organisms. That energy always travels in one direction — from producer to consumer. In a clover field, for example, energy is produced by a clover plant, which may be eaten by a rabbit, which subsequently is eaten by a fox. This process is called the "food chain." Natural ecosystems consist of complicated networks of many interconnected food chains, or "webs."

Each group of organisms occupies a "trophic" or feeding "level." All green plants in an ecosystem belong to the first trophic level, herbivores (creatures which eat plants) to the second, carnivores (meat-eaters) that eat herbivores to the third, carnivores that eat other carnivores to the fourth, and so on. Omnivores, creatures that eat both meat and plants, function at more than one level. Human beings are omnivores.

In the clover field, rabbits, mice and other herbivores feed on plants. In turn, weasels, hawks and other carnivores feed on the herbivores, gaining from them the energy and raw materials needed to grow and reproduce. The energy flow in a clover field illustrates the "grazing food web," in which living plants are the foundations.

Eventually, however, all plants and animals die, and their remains are the foundations of "detritus food webs," which are as important but less conspicuous than grazing food webs. Detritus food webs predominate in wet lands, where decomposers (e.g., bacteria), consume the remains of dead animals. Detritus pathways are also predominant on land. It is estimated, for example, that approximately ten percent (10%) of the leaves in the forest are eaten by herbivores. The rest are funnelled into the detritus pathway to be consumed by bacteria, fungi, millipedes, etc.

Most humans function as omnivores with varying percentages of meat and plant intake. Plant materials such as cereals, vegetables and fruits account for approximately 64% of the food consumed in the U.S., and about 89% of food consumed worldwide. Most of our meat comes from omnivores such as cattle, chickens and hogs. When we eat shellfish or mushrooms, we are tapping the detritus food web, but it makes up less than one percent (1%) of the average American's diet.

It is important to remember that energy flows through food webs in one direction only -- from lower to higher trophic levels. That is, creatures at lower trophic levels serve as a source of energy to creatures at higher trophic levels. Energy never flows in the reverse direction — from carnivores to herbivores to plants. In practical terms, this means that plants cannot eat rabbits, and that rabbits cannot eat foxes. Energy flows from producer to consumer, never the other way around.

Nature limits the number of organisms that can survive at each trophic level. Any radical changes in the character of a "food web" may have a devastating effect on this natural balance.

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ALL GROUPS

A-3 TWO VIEWS OF ANIMAL USE: THE ANIMAL RIGHTS VIEW

It is said that the modern animal rights movement began with the publication of Peter Singer's book, "Animal Liberation," published in 1975. But the animal rights philosophy actually has its roots much deeper in history. 19th century British philosopher Jeremy Bentham pointed to the capacity for suffering as the vital characteristic that gives all sentient beings the right to equal consideration. He wrote that the capacity for suffering — and/or enjoyment or happiness — is not just another characteristic like the capacity for language or higher mathematics. The capacity for suffering is a prerequisite for having interests at all, a condition that must be met before we can speak of rights.

Singer took Bentham's argument one step further by drawing a comparison between discrimination against humans (racism) and discrimination against animals (speciesism). According to Singer, the racist violates the principle of equality by giving greater weight to the interests of members of his/her race than to others. Similarly, the speciesist allows the interest of his/her species to override those of other species. The pattern, in Singer's view, is identical in each case.

In both the historic and modern views of animal rights, the key point is "sentience," or the capacity to experience pain or pleasure.

In the animal rights view, if a being is capable of suffering, there can be no moral justification for refusing to take that suffering into consideration. No matter the nature of the being, the principle of equality requires that its suffering be counted equally with the like suffering of any other being. It is true, of course, that we cannot know exactly how animals suffer. We know what pain feels like to us but not to others. We assume that our friends experience pain as we do. They don't have to speak a word. Screaming, writhing about, crying and other behavior tells us they are in pain. We see the same sort of behavior in animals.

In the animal rights view, the question is not merely whether an animal suffers as a consequence of any particular animal use. The question is whether humans have the right to exploit other sentient beings for any purpose. Even if a particular type of animal use is considered "humane" by traditional definitions, the fact that the animal has the **capacity** to suffer is sufficient to make its use unacceptable.

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A-4 TWO VIEWS OF ANIMAL USE: THE ANIMAL WELFARE VIEW

People are part of the natural world, and our relationship with animals is defined in large measure by the natural order. We know that humans and animals are inextricably tied together. In fact, we depend upon one another. It is virtually impossible for any living creature on this planet to exist without making use of fellow creatures. This is a fact that is unquestioned by any member of the animal kingdom with the exception of humans.

The notion of rights is a uniquely human one. Animals do not recognize the rights of other animals. They kill and eat one another as a matter of survival. But for humans, the concept of rights is a fundamental element of our social pact — the contract that permits us to live with one another in comparative harmony. As part of that contract, we recognize that rights are accompanied by responsibilities. In return for our rights as members of society, we accept the obligation to abide by society's laws.

But animals cannot be parties to contracts. If we are prepared to assign rights to animals, what responsibilities do we expect them to fulfill?

The American Veterinary Medical Association has defined animal welfare as "a human responsibility" to assure that the basic needs of animals are met. There is no question that our power over animals brings with it the responsibility to treat them with respect and compassion.

Although many cultures have vastly differing views and traditions of animal use, most western societies have adopted basic rules governing human behavior toward animals. In the U.S., laws have been enacted at the federal level to assure the welfare of animals in medical research labs as well as the health of dogs and cats raised in professional kennels. These laws are administered by the U.S. Department of Agriculture.

In addition, most communities have local laws and ordinances to protect animals from unnecessary cruelty. These rules address everything from pet neglect and abuse to the treatment of circus animals, and from hunting and fishing to meat packing. Without addressing the issue of whether animals have inherent rights, our society has enacted laws to govern the behavior of human beings in their interaction with animals.

In the animal welfare view, social traditions and the body of existing law with respect to our use of animals are based on the premise that man's right to use animals for human benefit carries with it the responsibility to do so humanely. These traditions and laws exist because for centuries man has recognized the wisdom and natural correctness of using animals for food, clothing, research, education and companionship.

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Congressional Committee

R-1
THE ECONOMIST

Congratulations! You have just been appointed to the Congressional Committee that will study animal use in the U.S. Your main job will be to contribute to recommendations concerning the long-term economic prosperity of the U.S., and the role of animal use in achieving this goal. Your recommendations will be important when it comes to deciding whether the government should actively support and promote animal use industries, leave them alone to thrive or decline on their own, or take steps to eliminate them and find other employment for people who depend on them.

You have been chosen for this task partly because of your personal qualities, and partly because of your professional competence as an economist. You represent an industrial district in a large mid-western city. You are an expert in economic policy. You understand the importance to America of a strong economy with flourishing domestic industries and the need for exports to other lands.

More important, you are widely known as having integrity and an open mind when dealing with controversial issues.

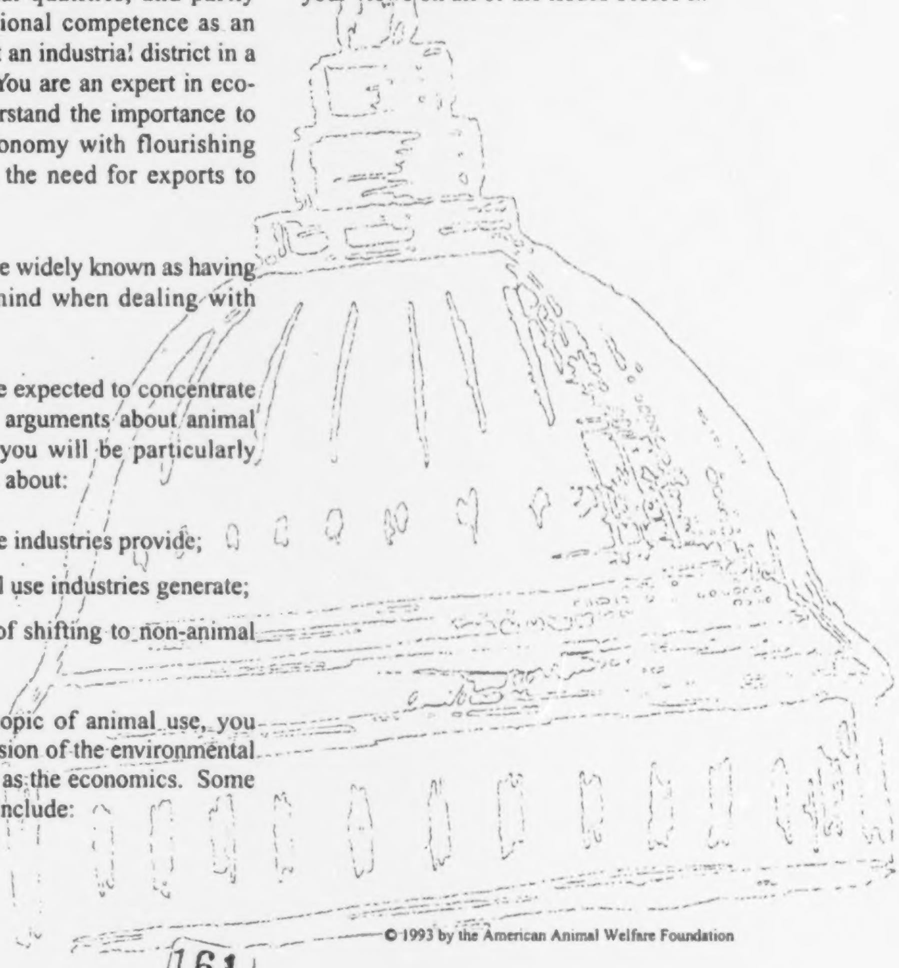
As a result, you will be expected to concentrate your attention on all the arguments about animal use. As an economist, you will be particularly concerned with questions about:

- the jobs that animal use industries provide;
- the revenue that animal use industries generate;
- the economic impact of shifting to non-animal substitutes or synthetics.

As you consider the topic of animal use, you will be involved in discussion of the environmental and ethical issues as well as the economics. Some of these questions might include:

- whether ethical objections to animal use outweigh economic considerations;
- whether the environment can sustain animal use;
- whether it is possible to balance economic, ethical and environmental concerns when it comes to animal use.

You are expected to listen carefully to the testimony you hear, and to work with your colleagues to produce a report that is well-reasoned, supported by the evidence, and fair. Remember, the Congressional Committee's final report should reflect your views on all of the issues before it.



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Congressional Committee

R-2
THE ENVIRONMENTALIST

Congratulations! You have just been appointed to the Congressional Committee that will study animal use in the U.S. Your main job will be to contribute to recommendations concerning long-term environmental conservation in the U.S., and the role of animal use in achieving this goal. Your recommendations will be important when it comes to deciding whether the government should actively support animal use in its environmental conservation policies, impose restrictions on animal use to minimize environmental impacts, or eliminate animal use industries completely to ensure that no environmental consequences are experienced.

You have been chosen for this task partly because of your personal qualities, and partly because of your professional competence in environmental conservation matters. You represent a rural mountain district, and understand the importance of conserving a healthy environment so our long-term survival is not threatened by waste and pollution. More important, you are widely known as having integrity and an open mind when dealing with controversial issues.

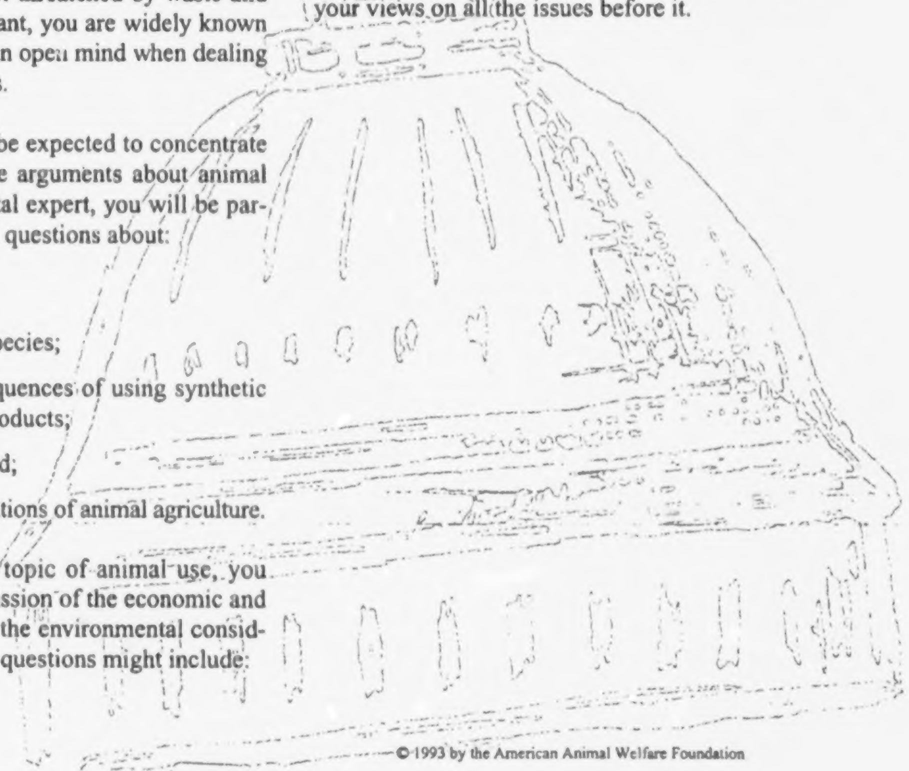
As a result, you will be expected to concentrate your attention on all the arguments about animal use. As an environmental expert, you will be particularly concerned with questions about:

- wildlife habitat;
- the conservation of species;
- environmental consequences of using synthetic alternatives to animal products;
- the proper uses of land;
- environmental implications of animal agriculture.

As you consider the topic of animal use, you will be involved in discussion of the economic and ethical issues as well as the environmental considerations. Some of these questions might include:

- whether ethical objections to animal use are consistent or inconsistent with sound environmental conservation policy;
- whether the economic benefits of animal use outweigh its environmental costs;
- whether the environment can be sustained better by continued animal use than by the elimination of animal use and the development of synthetic (non-animal) substitutes for animal products.
- whether it is possible to balance economic, ethical and environmental concerns when it comes to animal use.

You are expected to listen carefully to the testimony you hear, and to work with your colleagues to produce a report that is well-reasoned, supported by the evidence, and fair. Remember, the Congressional Committee's final report should reflect your views on all the issues before it.



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Congressional Committee

R-3

THE ETHICIST

Congratulations! You have just been appointed to the Congressional Committee that will examine animal use in the U.S. Your main job will be to contribute to recommendations concerning ethical standards and the relationship between these standards and animal use. Your recommendations will be important when it comes to deciding whether the government should regulate animal use as it has done in the past, impose stricter controls, or attempt to ban the use of animals completely.

You have been chosen for this task partly because of your personal qualities and partly because of your professional background. As a former member of the clergy and a teacher, you are an expert in ethical philosophy. You understand the importance to any society of developing and living by ethical standards. You also understand that there are sincere differences of opinion among people about what is right and wrong. You are widely known as having integrity and an open mind when dealing with controversial issues.

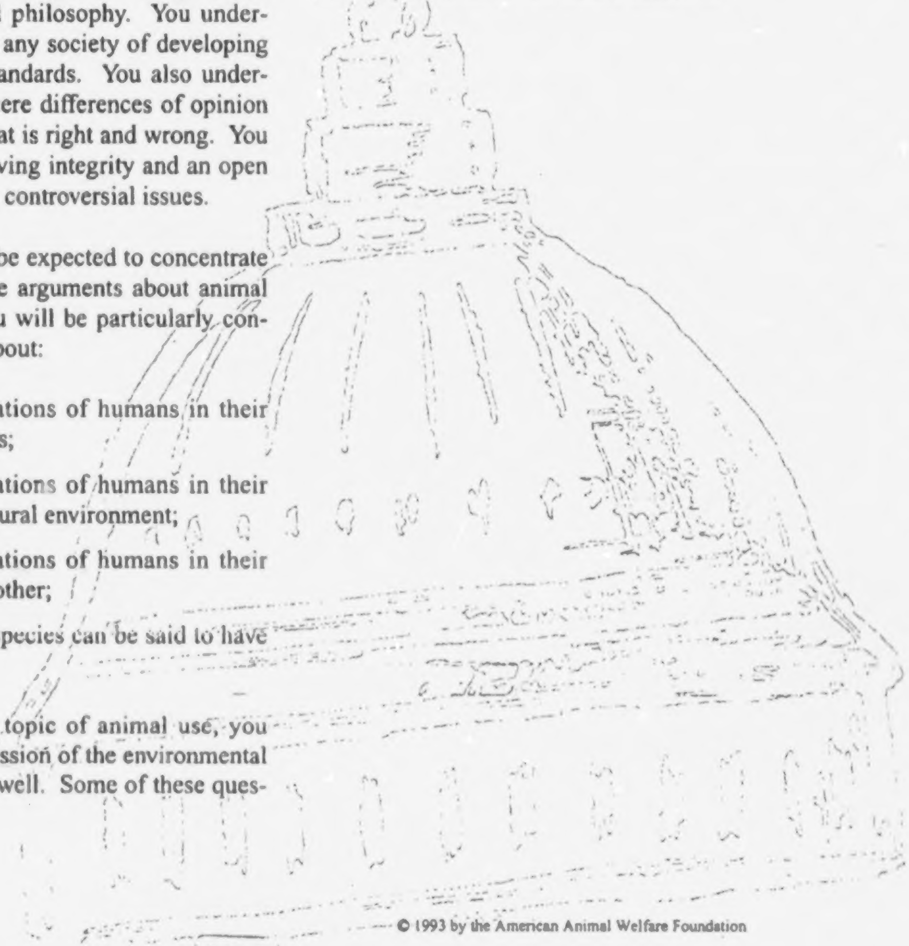
As a result, you will be expected to concentrate your attention on all the arguments about animal use. As an ethicist, you will be particularly concerned with questions about:

- the rights and obligations of humans in their interactions with animals;
- the rights and obligations of humans in their relationship with the natural environment;
- the rights and obligations of humans in their relationships with each other;
- whether non-human species can be said to have rights.

As you consider the topic of animal use, you will be involved in discussion of the environmental and economic issues as well. Some of these questions might include:

- whether the benefits of animal use outweigh the ethical objections to such use;
- whether animal use or "no use" is a more environmentally sound policy.
- whether it is possible to balance economic, ethical and environmental concerns when it comes to animal use.

You are expected to listen carefully to the testimony you hear, and to work with your colleagues to produce a report that is well-reasoned, supported by the evidence, and fair. Remember, the Congressional Committee's final report should reflect your views on all of the issues before it.



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Congressional Committee

D-1

CONGRESS APPOINTS A COMMITTEE ON ANIMAL USE

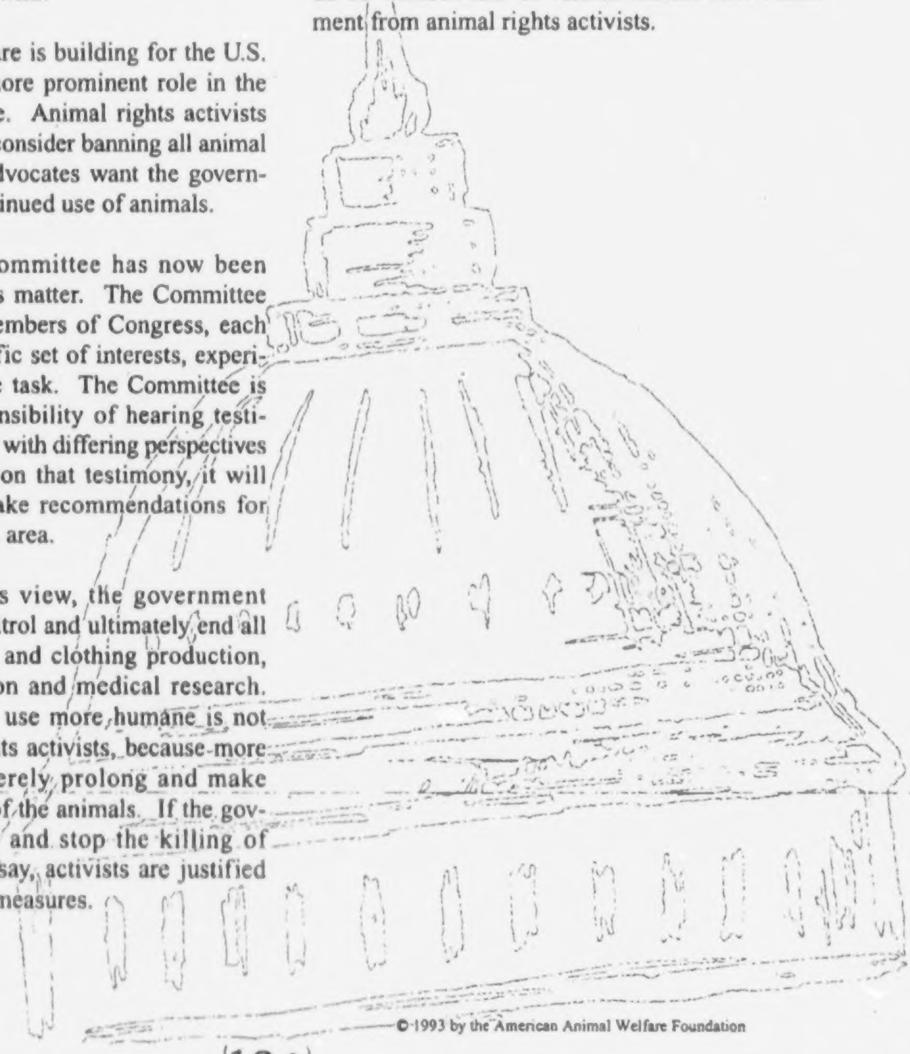
The U.S. Congress has received many requests to address the issue of animal use. These requests have come from a wide variety of people, each with different views and interests. Until now, the government has taken a middle position. Federal laws have been passed regulating the harvesting of wildlife, as well as the handling of animals in food production and processing, commercial kennels and research laboratories. Many state and local laws have also been passed banning inhumane treatment of domestic animals and regulating the taking of animals in the wild.

Now, however, pressure is building for the U.S. government to take a more prominent role in the debate about animal use. Animal rights activists want the government to consider banning all animal use. Animal welfare advocates want the government to support the continued use of animals.

A Congressional Committee has now been established to study this matter. The Committee will consist of three members of Congress, each of whom brings a specific set of interests, experience and abilities to the task. The Committee is charged with the responsibility of hearing testimony from many groups with differing perspectives on animal use. Based on that testimony, it will determine facts and make recommendations for future U.S. policy in this area.

In the animal rights view, the government should enact laws to control and ultimately end all use of animals in food and clothing production, entertainment, education and medical research. Merely making animal use more humane is not enough, say animal rights activists, because more humane conditions merely prolong and make more palatable the use of the animals. If the government won't step in and stop the killing of innocent animals, they say, activists are justified in taking more extreme measures.

In the animal welfare view, the government should work cooperatively with animal industries to assure the humane treatment of animals, but should take the strong position that animal use is essential to our nation's economy and way of life. Since the right to use animal products if we choose is basic to a free society, say the animal welfare advocates, the government should actively support and promote animal industries, and assure that those who wear leather, eat meat, keep pets and benefit from medical research can continue to do so without fear of violent attacks and harassment from animal rights activists.



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Congressional Committee

D-2

MEMBERS OF THE COMMITTEE

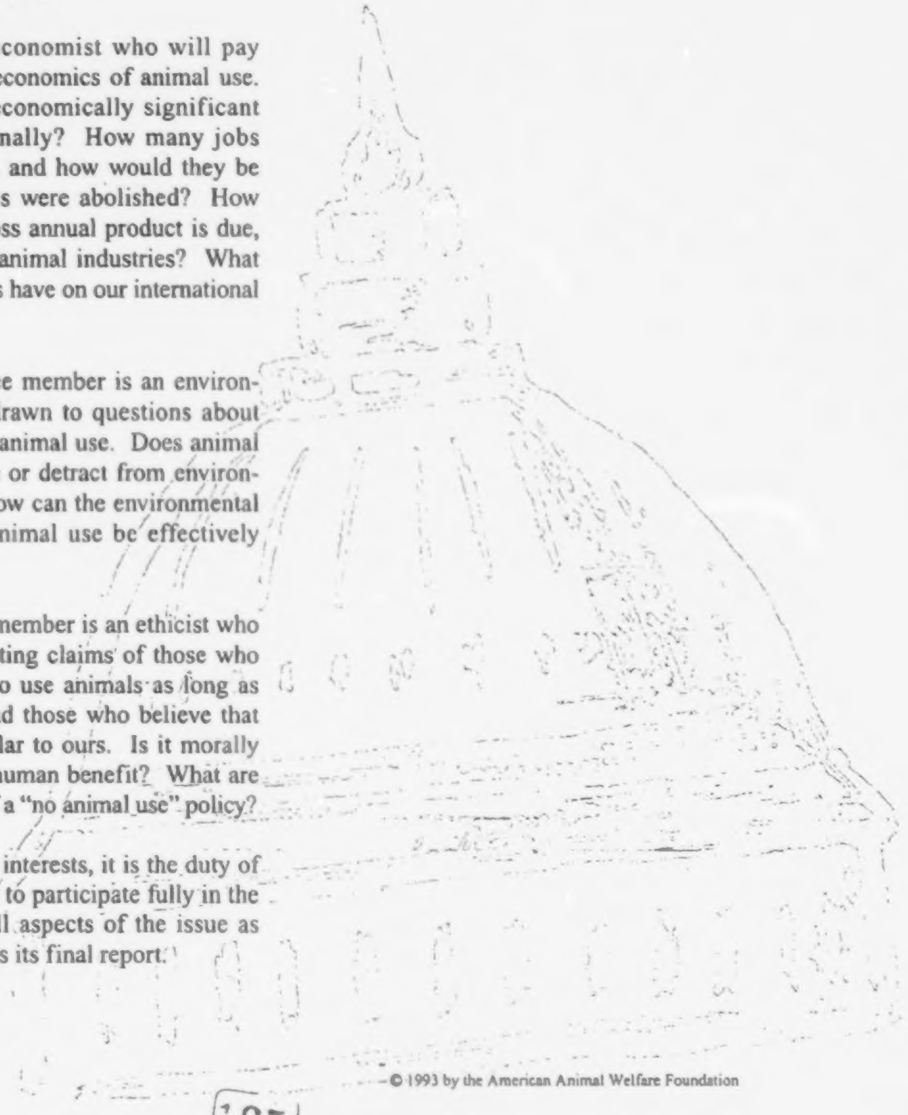
Each member of the Congressional Committee has a specific area of expertise, and a particular interest in one aspect of the issue of animal use in the U.S. Since each is a democratically elected member of Congress, they must take into account not only their own ideas but the beliefs, wishes and interests of the people who elected them. As representatives of the people, they must continually balance the needs and desire of their constituents with their own individual views.

One member is an economist who will pay special attention to the economics of animal use. Are animal industries economically significant regionally and/or nationally? How many jobs exist in these industries, and how would they be replaced if the industries were abolished? How much of our nation's gross annual product is due, directly or indirectly, to animal industries? What impact do these industries have on our international economic position?

The second Committee member is an environmentalist who will be drawn to questions about the ecological impact of animal use. Does animal use in general contribute or detract from environmental conservation? How can the environmental concerns surrounding animal use be effectively addressed?

The third Committee member is an ethicist who must balance the conflicting claims of those who believe it is acceptable to use animals as long as we do so responsibly, and those who believe that animals have rights similar to ours. Is it morally right to use animals for human benefit? What are the ethical implications of a "no animal use" policy?

Despite these specific interests, it is the duty of each Committee member to participate fully in the hearings and consider all aspects of the issue as the Committee formulates its final report.



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Congressional Committee

D-3

THE POLITICS OF ANIMAL USE ISSUES

Elected officials are accustomed to hearing from their constituents about various political and social issues. But many politicians have been shocked by the volume of communication they receive from people representing both sides of the animal rights issue. In recent Congressional sessions, elected leaders have received more mail on the animal rights issue than on almost any other issue.

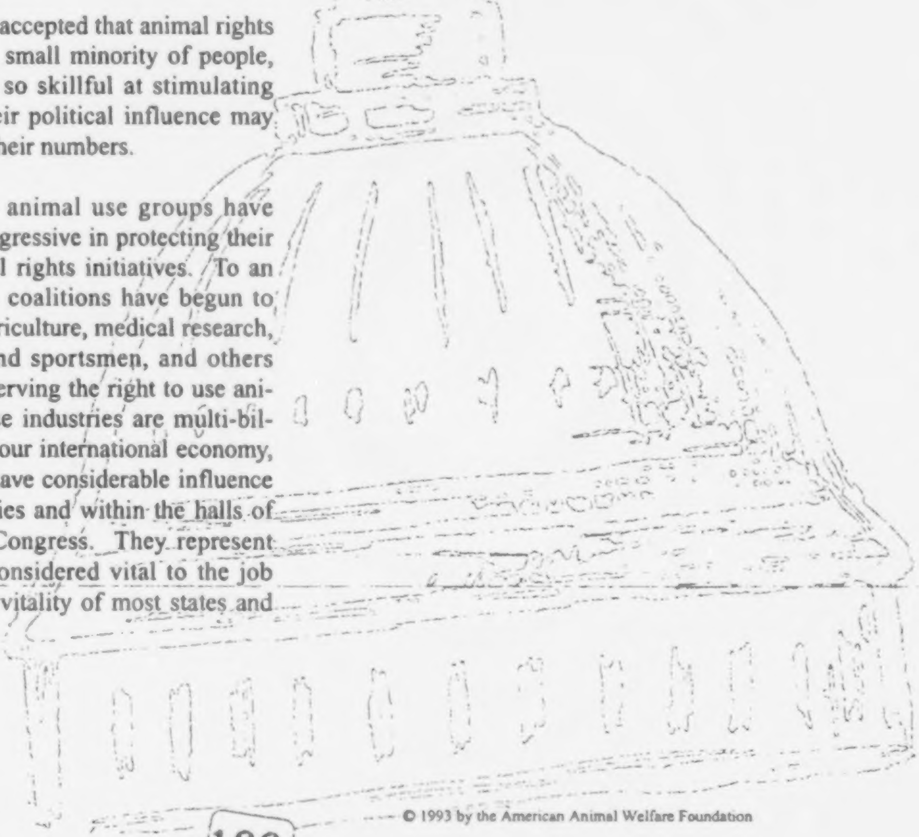
Animal rights groups have successfully generated millions of dollars in donations, much of which is used to mobilize grass roots support for legislative and consumer initiatives. Even more important, professional animal rights activists have learned how to generate extensive media coverage using protests and highly visual special events tailored for television and news photographers.

While it is generally accepted that animal rights proponents represent a small minority of people, they are so vocal and so skillful at stimulating press coverage that their political influence may be disproportionate to their numbers.

On the other hand, animal use groups have become increasingly aggressive in protecting their interests against animal rights initiatives. To an unprecedented degree, coalitions have begun to emerge representing agriculture, medical research, pet owners, hunters and sportsmen, and others with an interest in preserving the right to use animals. Since animal use industries are multi-billion dollar elements of our international economy, many of these groups have considerable influence in their own communities and within the halls of state legislatures and Congress. They represent industries which are considered vital to the job security and economic vitality of most states and our nation.

Most people agree that the role of government is to assure that business and private citizens conduct themselves in ways which society finds acceptable. In most cases, government steps in when companies or individuals fail to meet their obligations willingly. Government has passed laws to protect animals from improper treatment and abuse. In most cases, however, government has left it to others to define what constitutes "abuse."

Recent legislative initiatives spearheaded by the animal rights movement have made the question of definitions even more important. If government is to enact policies with respect to animal use, whose definitions will apply? Will "responsible use" and "abuse" be defined by animal rights activists, by animal user groups, by veterinarians, by scientists, or by politicians?



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The Association for Animal Rights

R-1
THE ASSOCIATION FOR ANIMAL RIGHTS

As an animal rights activist, you believe that our whole system of using animals for human benefit must change. To be consistent, you believe serious activists should be prepared to oppose the use of animals for food and clothing, medical research, product testing, education, recreation, entertainment and companionship. The animal rights philosophy has been expressed by its leaders in this way: "Animals are not ours to eat, wear or experiment on." Animal rights groups actively oppose:

- consumption of meat, fish and poultry
- consumption of eggs, dairy products and honey
- the use of fur, leather, wool, silk and goosedown
- the use of animals in biomedical research
- the use of animals in product safety testing
- zoos, aquariums, circuses and rodeos
- hunting, fishing and trapping
- pet ownership

Some people may view these positions as extreme, but animal rights advocates believe they are well within the reach of a compassionate society, if we just stop giving traditional excuses for animal exploitation. For example, one of the most common justifications for animal use is the Bible's reference to 'man's dominion over animals.' However, animal rightists note that for centuries, this same passage was used to defend human slavery. Dominion, activists say, means that humans have a responsibility to care for animals, and not an inherent right to destroy them.

As an animal rights supporter, you believe it is not enough to make animal use more humane; you will not be satisfied until all exploitation of animals has ceased. As Tom Regan, an animal rights philosopher, has written, "It is not larger, cleaner cages that justice demands...but empty cages; not more humane hunting and trapping, but an end to these barbarous practices; not traditional animal agriculture but a complete end to all commerce in the flesh of dead animals."

While some groups promote animal welfare reforms in agriculture and medical research, animal rights advocates often reject such reforms as falling short of the mark. Animal rights advocate Gary Francione has said, "...the enactment of animal welfare measures actually impedes the achievement of animal rights." In Francione's view, anything that makes animal use more humane and therefore more palatable to the public merely prolongs the exploitation of other living creatures.

Therefore, it is not enough to curb "excessive" cruelty or to stop "unnecessary" animal use. If we believe that animals have rights as sentient beings, then we must stop all animal use, regardless of how humane the procedure or how important the result for human beings.

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The Association for Animal Rights

D-1

A RATIONALE FOR ANIMAL RIGHTS

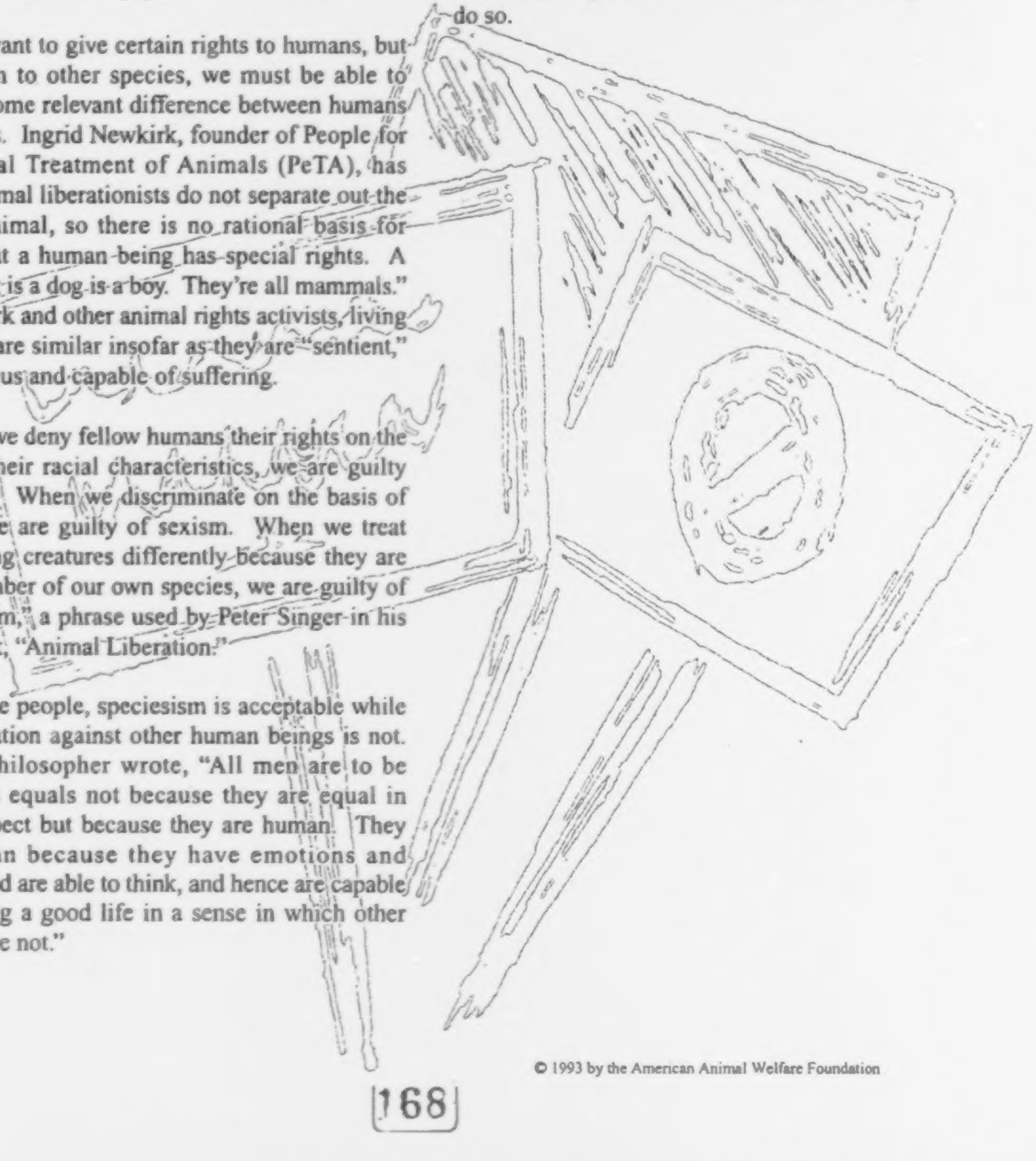
Most people agree that all human beings have certain basic rights such as the right to life and liberty. We call these "human" rights. To discriminate against a person because of age, ethnic origin, gender or religion is increasingly unacceptable. It is true that no two individuals are the same. However, our democratic traditions are based upon the notion that everyone ought to be treated equally, and no one should suffer discrimination because of cultural or physical differences.

If we want to give certain rights to humans, but deny them to other species, we must be able to point to some relevant difference between humans and others. Ingrid Newkirk, founder of People for the Ethical Treatment of Animals (PeTA), has said, "Animal liberationists do not separate out the human animal, so there is no rational basis for saying that a human being has special rights. A rat is a pig is a dog is a boy. They're all mammals." To Newkirk and other animal rights activists, living creatures are similar insofar as they are "sentient," or conscious and capable of suffering.

When we deny fellow humans their rights on the basis of their racial characteristics, we are guilty of racism. When we discriminate on the basis of gender, we are guilty of sexism. When we treat other living creatures differently because they are not a member of our own species, we are guilty of "speciesism," a phrase used by Peter Singer in his 1975 book, "Animal Liberation."

To some people, speciesism is acceptable while discrimination against other human beings is not. As one philosopher wrote, "All men are to be treated as equals not because they are equal in every respect but because they are human. They are human because they have emotions and desires, and are able to think, and hence are capable of enjoying a good life in a sense in which other animals are not."

However, animal rights activists reject this position. Animals may not have the same thoughts and emotions as humans, and they may not think in the same way, but we know that they are capable of some forms of thought. We know that animals are capable of feeling both pain and pleasure. For this reason, they must receive consideration equal to that which we offer to fellow human beings. Even though humans have the power to use and abuse other species, we have no inherent right to do so.



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The Association for Animal Rights

D-2

CHANGE THROUGH ACTIVISM

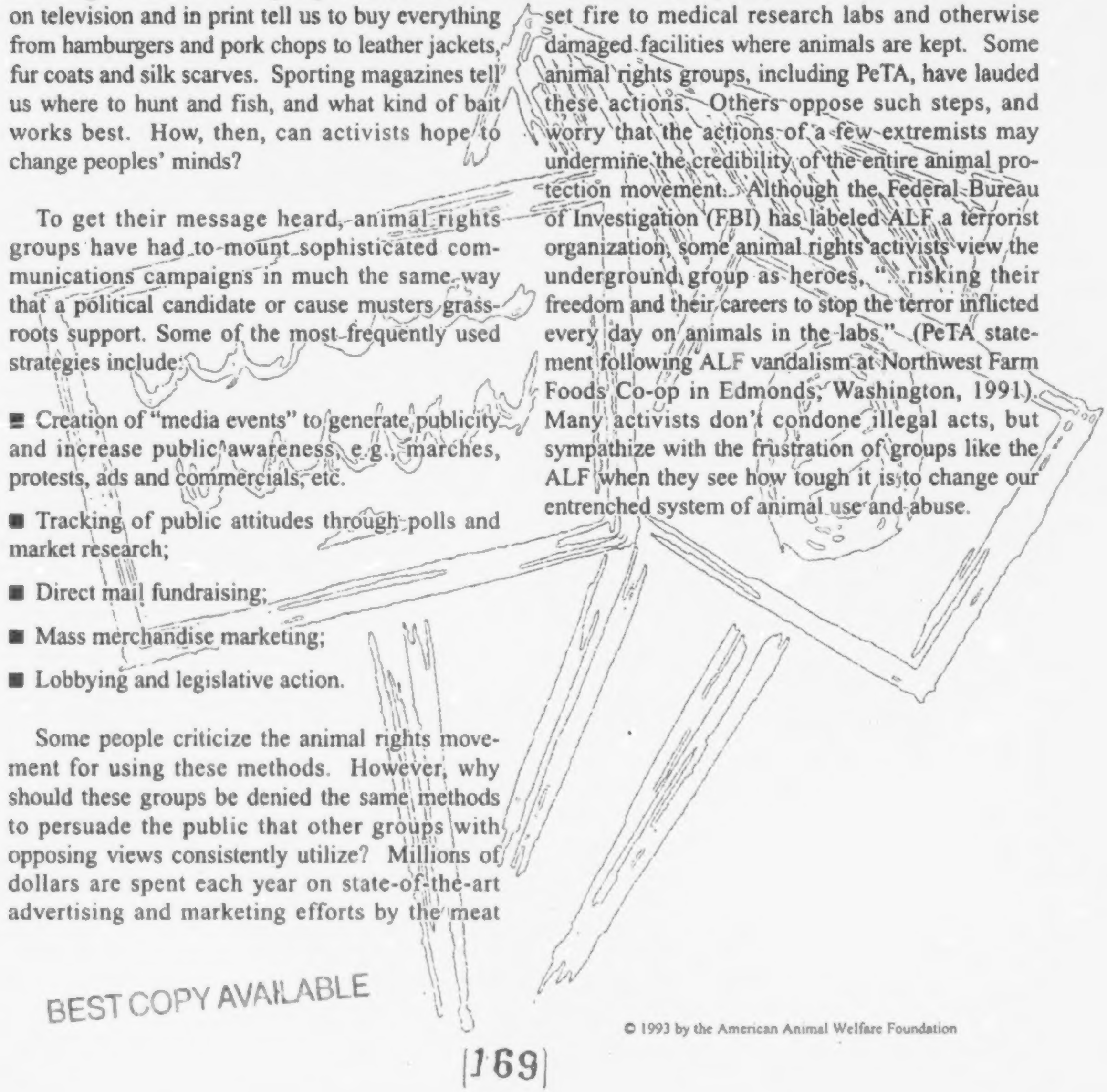
Many animal rights advocates have formed organizations to raise money and generate media coverage to change public attitudes toward animal use. Since animal use is such a widely accepted part of our culture, changing public attitudes is a tough job. Despite their efforts, a majority of people in our society still think it's acceptable to use animals for human purposes. After all, we are surrounded with messages which reinforce and encourage animal use every day. Advertisements on television and in print tell us to buy everything from hamburgers and pork chops to leather jackets, fur coats and silk scarves. Sporting magazines tell us where to hunt and fish, and what kind of bait works best. How, then, can activists hope to change peoples' minds?

To get their message heard, animal rights groups have had to mount sophisticated communications campaigns in much the same way that a political candidate or cause musters grassroots support. Some of the most frequently used strategies include:

- Creation of "media events" to generate publicity and increase public awareness, e.g., marches, protests, ads and commercials, etc.
- Tracking of public attitudes through polls and market research;
- Direct mail fundraising;
- Mass merchandise marketing;
- Lobbying and legislative action.

Some people criticize the animal rights movement for using these methods. However, why should these groups be denied the same methods to persuade the public that other groups with opposing views consistently utilize? Millions of dollars are spent each year on state-of-the-art advertising and marketing efforts by the meat industry, the fur trade and other businesses with an economic interest in killing animals. By using equally up-to-date tactics, the animal rights movement merely assures that the debate over animal use will be carried out on a level playing field.

In addition to the methods described above, some animal rights advocates take their activism a step further. Organizations such as the Animal Liberation Front (ALF) have vandalized fur stores, set fire to medical research labs and otherwise damaged facilities where animals are kept. Some animal rights groups, including PeTA, have lauded these actions. Others oppose such steps, and worry that the actions of a few extremists may undermine the credibility of the entire animal protection movement. Although the Federal Bureau of Investigation (FBI) has labeled ALF a terrorist organization, some animal rights activists view the underground group as heroes, "...risking their freedom and their careers to stop the terror inflicted every day on animals in the labs." (PeTA statement following ALF vandalism at Northwest Farm Foods Co-op in Edmonds, Washington, 1991). Many activists don't condone illegal acts, but sympathize with the frustration of groups like the ALF when they see how tough it is to change our entrenched system of animal use and abuse.



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The Association for Animal Rights

D-3

THE CASE AGAINST ANIMAL RESEARCH

Ever since scientists began using live animals in experiments, some people have opposed this activity. During the mid-19th century, opposition in England to animal experimentation became so strong that members of the royal family founded the Royal Humane Society. Later this movement spread to the United States, where organizations such as the New England Anti-Vivisection Society (NEAVS) have joined animal rights groups such as PeTA in calling for an end to all experiments using animals.

To those opposed to animal research, it does not matter whether the experiments are performed humanely. As one animal rights leader has said, "Even painless research is fascism, supremacism, because the act of confinement is traumatizing in itself." Animal rights philosopher Tom Regan has written, "Even granting that we (humans) face greater harm than laboratory animals presently endure if...research on these animals is stopped, the animal rights view will not be satisfied with anything less than total abolition." (Regan, *The Case for Animal Rights*, 1983.)

Most people expect that the medications and cosmetics we use have been tested and proven safe. However, many fail to understand that millions of animals have suffered and died in the process. Increased public awareness of the plight of laboratory animals has resulted in pressure upon the scientific community to develop alternatives to animal research.

While some scientists embrace "the three R's" — **reduction** of the number of animals used in experiments, **refinement** of techniques to minimize pain and suffering, and **replacement** of animals with other models when possible — animal rights supporters feel that **replacement** is the only truly acceptable alternative. They reject the view that some types of animal research are more "justifiable" or "legitimate" than others. Indeed, the animal rights view suggests that there is no end which justifies the means of animal experimentation. As PeTA's Newkirk has said, "Even if animal research resulted in a cure for AIDS, we'd be against it."

Some people may view this attitude as "anti-scientific," but in fact it is not. In the animal rights view, the pursuit of knowledge for human benefit is justified as long as it does not conflict with the inherent rights of animals. Most research can be done without using laboratory animals; if that means there are some things we cannot learn, society must simply accept this as the price of compassion.

Besides, there is no significant evidence that animal testing really teaches us anything we couldn't learn from other methods. According to *The Handbook for Medical Sociology*, only 3.5% of the 40% decrease in mortality in the U.S. between 1910 and 1984 resulted from medical measures that have been advanced through animal experimentation. As far as drugs and cosmetics are concerned, human beings have the option of choosing to use or not to use such products. Research animals are given no such choice in the matter.

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The Association for Animal Rights

D-4

THE CASE AGAINST EATING MEAT

Of all forms of animal use, meat consumption is among the most objectionable to animal rights activists. In addition to the pain and suffering of animals raised for meat, the process of cattle farming has serious social, environmental and ecological implications for our entire planet.

With the abundance of food in our society, it is difficult to grasp the fact that many poor nations cannot feed their people. Recent famines in Africa are compelling evidence of the need for our world to come to grips with the fact that countless thousands continue to die from lack of food and water while we waste large quantities of both on cattle-raising in the U.S. and elsewhere.

Few people recognize that farms compete with wild animals for space and resources. Ninety percent of farmland is used for raising livestock and only ten percent for crops. This grazing land is unavailable as habitat for wildlife. Farm animals require between ten and one thousand times the amount of water and energy that plants do in order to produce the same amount of food. If meat were replaced by vegetables, fruits and grains, it would be possible to feed every starving person in the world and have plenty left over. It would also restore some farm land to the wildlife which formerly thrived on it.

A vegetarian diet would also improve the health of the planet's people. One of the major causes of death in the U.S. is heart disease, complicated by the over-consumption of animal fat and resulting obesity.

A shift away from cattle farming would also improve the ecology. Few people understand that livestock are one of the primary sources of gaseous pollutants in our air. It has been estimated, for example, that over its lifetime a single steer ejects 200 pounds of carbon dioxide into the atmosphere for every 4-ounce hamburger produced from its carcass. As if that weren't bad enough, over-grazing also contributes to soil erosion, and the use of medications and chemicals in farming lead to contaminants in the food chain.

Worst of all, domestic animals live in misery, many inhumanely confined in cages from birth to slaughter. Cows, pigs and sheep did not choose to be domesticated; human beings simply decided their fate. Even though some farmers may try to use humane methods, the bottom line is the same: the animals die.

As we near the 21st century, our society is beginning to understand the importance of showing respect for all living creatures on our planet. Eating meat is, in the words of Jeremy Rifkin, "an arcane, anachronistic tradition, a remnant of our past." Animal rights activists believe it is time for people to accept the fact that we have no right to eat other living creatures merely because we have the power to do so.

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D-5

THE CASE AGAINST LEATHER AND FURS

In prehistoric times it may have been necessary for humans to wear the skins of animals to keep warm. But in today's modern world, there are many synthetic alternatives to animal products. Killing animals for their skin is no longer justified.

Mink, fox and other furbearing animals raised on farms are wild animals, and should be allowed to live in their natural environments, not imprisoned in pens waiting to be made into coats. Conditions on many fur farms are inhumane, but even if they weren't, it would still be unacceptable to keep the animals there. The fact that farm-raised mink are raised "for that specific purpose" doesn't make any difference; these wild animals don't belong on farms in the first place. Humans have no right to kill these animals just to obtain an unnecessary luxury like fur.

Fur which comes from animals caught in the wild is equally unacceptable. Trapping is terribly cruel and inhumane. Animals caught in steel-jaw leghold traps are often seriously injured and spend many hours in terrible pain and stress. Too often, the animals caught in traps aren't the ones that were targeted in the first place; cats, dogs and other non-target species are often caught instead. Although trappers claim that their work helps to "control animal populations," the truth is that nature achieves its own balance in its own way. A natural death in the wild is far preferable than a painful death at the hands of a trapper.

Some people feel that using leather is slightly easier to justify because it is a byproduct of meat production. True animal rightists, however, oppose meat consumption as strongly as they do the use of cowhide and other animal skins to produce leather. Leather is no more acceptable than fur just because it is a byproduct and not the purpose of the animal's death.

As animal rights philosopher Tom Regan has said, "The philosophy of animal rights is uncompromising in its response to each and every injustice animals are made to suffer. It is not larger, cleaner cages that justice demands...but empty cages; not traditional animal agriculture but an end to all commerce in the flesh of dead animals; not more humane hunting and trapping but the total eradication of these barbarous practices."

In the fight to end animal abuse of all kinds, getting rid of fur and leather is a good place to start. In recent years, durable and attractive alternatives to both have been developed. World-famous explorers have used these synthetic alternatives to keep warm on Arctic expeditions, so we know that these artificial fibers keep people as warm as they need to be.

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D-6
DO ANIMALS FEEL?

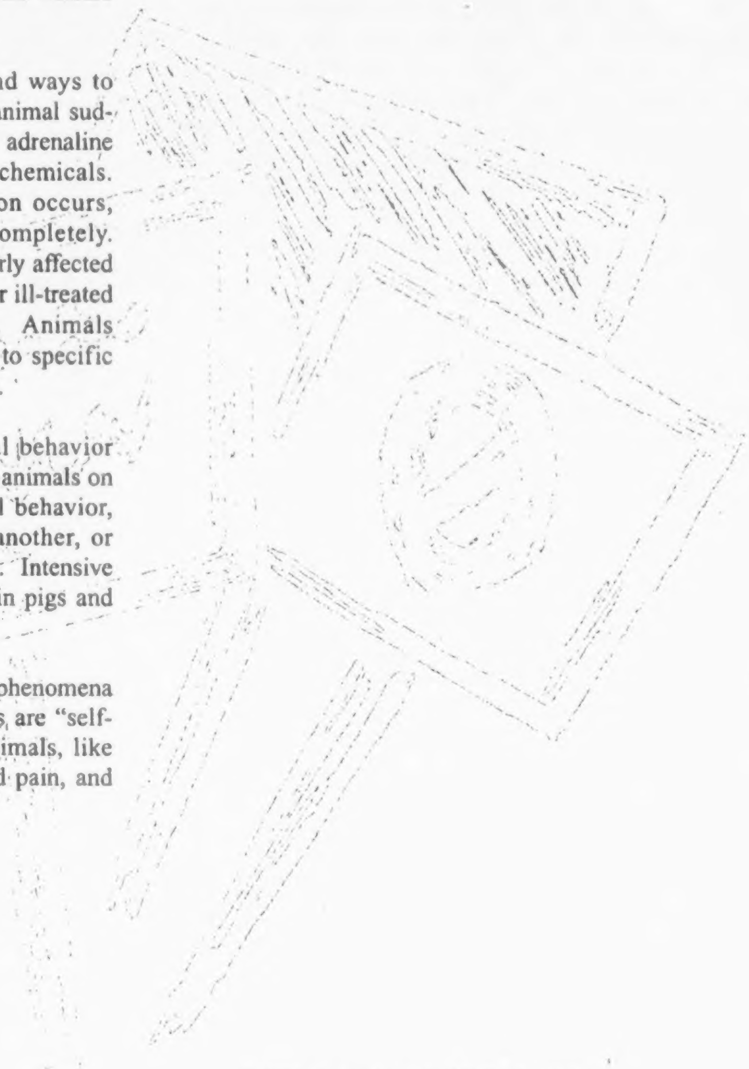
Human beings have a difficult time understanding what other humans are feeling, so it is not surprising that most of us find it almost impossible to imagine what happens in the mind of a mouse or rat. What kind of a test would we administer to determine whether any animal is "happy" or "content?" Since these are subjective measures, it is extremely difficult to test for them in a scientific way. However, scientists have identified certain objective tests to assess the welfare of animals.

For example, scientists have found ways to measure stress in animals. When an animal suddenly faces danger, hormones such as adrenaline are released, along with other body chemicals. When prolonged stress or frustration occurs, adaptive mechanisms break down completely. Reproductive mechanisms are particularly affected by stress, which explains why abused or ill-treated animals seldom reproduce normally. Animals react in predictable, measurable ways to specific kinds of stress or unpleasant conditions.

There is also evidence that animal behavior changes under prolonged stress. Some animals on farms or in zoos exhibit pathological behavior, including biting themselves or one another, or pulling feathers out of their own heads. Intensive farming has caused similar behaviors in pigs and chickens.

These physiological and behavioral phenomena do not conclusively prove that animals are "self-aware." But they do confirm that animals, like humans, are conscious of pleasure and pain, and react to both.

As human beings, our consciousness of pleasure and pain helps us understand the past, respond to the present and anticipate the future. We cannot be sure that animals have the same capacity, but we cannot be sure that they don't. In the face of such uncertainty, animal rights activists believe that our continued use of animals for our own purposes amounts to nothing more than oppression.



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Conservation Society of America

R-1
THE CONSERVATION SOCIETY OF AMERICA

In 1949, conservationist Aldo Leopold wrote a book called *A Sand County Almanac*, in which he set forth what has become the modern "conservation ethic." Leopold's basic message was that land and people must live in harmony with one another. He recognized that humans need to use natural resources — to cut trees, plow prairies, shoot game, and so on — but he believed that a portion of the land should be left wild so that future generations would know, as he had, what it meant to be part of "wild country."

Leopold believed that man, as an integral part of nature, must assume responsibility for conserving and protecting the natural resources of our world. "The problem," he wrote, "is how to bring about a striving for harmony with the land among a people many of whom have forgotten there is any such thing as land, among whom education and culture have become synonymous with landlessness."

Leopold's thinking has shaped the agenda of many modern conservation organizations. The Conservation Society of America, of which you are a member, has identified several important environmental values which the group strives to promote. The society's membership is comprised of wildlife experts, hunters, naturalists, park and game preserve supporters, wildlife photographers, and even some tourist groups. Conservationists see a wide range of values in our natural environment, including:

- biological value (maintenance of the ecosystem);
- educational value (what we learn from nature);
- commercial value (the economic benefits of the wilderness);
- recreational value (sports and leisure activities);
- aesthetic value (appreciation of natural beauty).

To the extent that activities are consistent with these values, you support them. For instance, most conservationists have no moral objection to hunting for subsistence or sport. However, they often oppose actions which might have a detrimental effect on wildlife habitat or the survival of threatened or endangered species.

Many conservation groups work hard and spend millions of dollars to provide and maintain habitats for various species — areas where animals can find food, water and cover in which to live and raise their young. Working as volunteers, often in cooperation with county, state and federal agencies, dedicated sportspeople and conservationists are striving to offset the effects of urban sprawl and continuing development on our wildlife resources.

Conservationists rely on scientific data from wildlife biologists and environmental experts to assess the effects of human activities on the land and its plant and animal life. These scientific findings form a basis for making future decisions about the wise use of our natural resources.

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Conservation Society of America

D-1
WILDLIFE MANAGEMENT: GIVING NATURE A HAND

In an increasingly urbanized society like ours, it is all too easy for human beings to feel separated from nature. In many respects, those who spend time interacting with nature through hunting, fishing, trapping, hiking, photography or other pastimes, act as society's bridge with the natural world. They serve as our "eyes and ears" on the land. Many sporting and wildlife enthusiasts provide important information to wildlife managers and ecologists about changing conditions or threats to wildlife. Several years ago, for example, fishermen on inland lakes began noticing that there were no longer fish in waters which had once been productive. This observation led to recognition of a new and serious environmental problem — acid rain.

According to the International Union for the Conservation of Nature and Natural Resources, more than a thousand species of vertebrates (fish, mammals, amphibians, birds and reptiles) are at present threatened with extinction around the world. Of those, about 67% became endangered by habitat destruction, about 37% by over-harvesting; and about 17% by competition from other species. Some species, of course, may have been affected by more than one of these factors.

International and U.S. federal laws have been adopted to prevent further losses among certain species. As a result, no land-based animal which is currently farmed or trapped for food or clothing is endangered by over-harvesting. In fact, many wild animals, including furbearers, are more plentiful today than at any time in our nation's recent history. This is due in large part to modern wildlife management methods.

Wildlife management is a science which seeks to maintain the greatest possible numbers and varieties of wildlife on a continuing basis, while still protecting the best interests of human society. A well-managed wildlife resource is healthy, productive and in balance with the surrounding environment. Most wildlife management programs contain two basic elements:

1) Research — on habitat needs, population changes, ecological relationships between species and wildlife reactions to human activity;

2) Policy — specific goals with respect to habitats and wildlife species, and strategies to achieve them.

Common wildlife management tools include regulated hunting, fishing and trapping. Without these tools, some species — especially herbivores — would increase to the point where the remaining wilderness would be overrun with hungry animals. Those that did not die from starvation would be subject to disease and parasites. The result would be disaster for the habitat and for the animals themselves. Surplus animal populations can be disastrous for humans as well. In some areas where trapping has been banned, rabid skunks and raccoons have overrun suburban neighborhoods, posing a serious health threat to people and pets.

Some people feel that humans should stop interfering, and "let nature take its course." That might be possible if our world was the same as it was centuries ago. But of course it isn't. The presence of humans has already profoundly altered the natural landscape. It's too late for us to remove ourselves from the natural equation. Our only choice now is to act responsibly, manage our natural resources wisely, and develop policies which assure the continued availability of those resources for future generations.

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Conservation Society of America

D-2

HUNTING AND CONSERVATION

Hunting has always been an important part of the human experience. From the earliest days, prehistoric hunters provided food and clothing for their families. Even when humans learned how to grow their own food on farms, hunting continued, an enduring human tradition rooted deep in our human memory.

Today, most people who hunt view this activity as a way of maintaining contact with that special tradition. To them, it is a means of reconfirming human relationships with nature and the other living creatures on the planet. Responsible hunters take only what is legal and can be productively used without waste.

Some people oppose hunting because few of us rely on the sport for survival. What they don't understand is that hunting is also an important tool of modern wildlife management.

In recent years, we have learned a great deal about how nature works. The laws of nature dictate that only a limited number of each species of wildlife can survive. The number that can survive in a given area is said to be the "carrying capacity" for that area. The only way to increase the carrying capacity for a given species is to improve the habitat. In the meantime, the number of animals exceeding the carrying capacity — the "surplus" — will die. What many people do not realize is that, for some wildlife species, the surplus is as high as 80% of the annual peak population.

There are a number of mortality factors (causes of death) which, when combined, equal the surplus which must die every year. These factors include predatory animals, disease, accidents, starvation and dehydration (loss of bodily moisture). If the numbers taken by hunters and trappers are reduced, then more will die of other causes. Many animals, if not taken by humans, will die from nature's less humane options such as disease and starvation, experiencing more prolonged suffering than the comparatively swift death of an animal killed by a hunter.

Most hunters make every effort to be responsible, but there still remain a few careless individuals. To address this problem, many hunting organizations have cooperated with state governments to develop educational programs which not only offer information on the most recent technological advances but also include formal classes in ethics, capture techniques and principles of conservation. State licensing programs often stipulate that hunters must receive such education before a license can be issued. In addition, hunters work closely with wildlife management and law enforcement officials to assure that conservation laws are observed, that poachers (people hunting illegally) are caught and prosecuted, and that changes in local ecosystems are quickly reported.

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Conservation Society of America

D-3

CONSERVATION AND NATIVE CULTURES

Because we live in a highly modern and technological world, it is sometimes hard to remember that other cultures and lifestyles continue to exist and flourish in the global community. From Alaska and northern Canada into Greenland, Scandinavia and the former Soviet Union, people continue to live close to the land, hunting for meat and fur.

In these often remote locations, hunting, fishing and trapping are an ancient and integral part of the local culture. Natives in these regions rely on the wildlife around them for food, clothing and subsistence. Their use of animals results in no waste, and no harm to polar or subarctic environments.

Native Americans in the United States also have a special relationship to the land they inhabit. This special relationship has been recognized in treaties between various tribal governments and the federal government of the U.S. Even with the dramatic changes on Indian reservations in recent years, Indians continue to cherish the special hunting and fishing rights accorded them by these agreements. For most tribes, their cultural identity is seamlessly intertwined with the living creatures indigenous to their homelands.

It is a fundamental concept of human rights that people be allowed to live the lifestyles they choose. Even if we don't fully understand these cultures, we must respect them. Native cultures reflect the rich and diverse traditions of centuries ago; our modern society derives great benefit from the preservation of those traditions. Just as we celebrate and cherish the diversity of animal life on our planet, so too must we celebrate the stunning diversity of human traditions and experience.

In locations such as Alaska, northern Canada, Greenland, Scandinavia and the former Soviet Union, hunting is more than just a popular pastime. It is a way of life growing out of the special relationship between native people and the lands they inhabit. Often, hunting, fishing and trapping are an ancient and integral part of the local culture. While ours is a modern and technologically sophisticated world, we must respect those who rely on the wildlife around them for food, clothing and subsistence. Whether we hunt for sport or survival, we have an obligation to do so responsibly.

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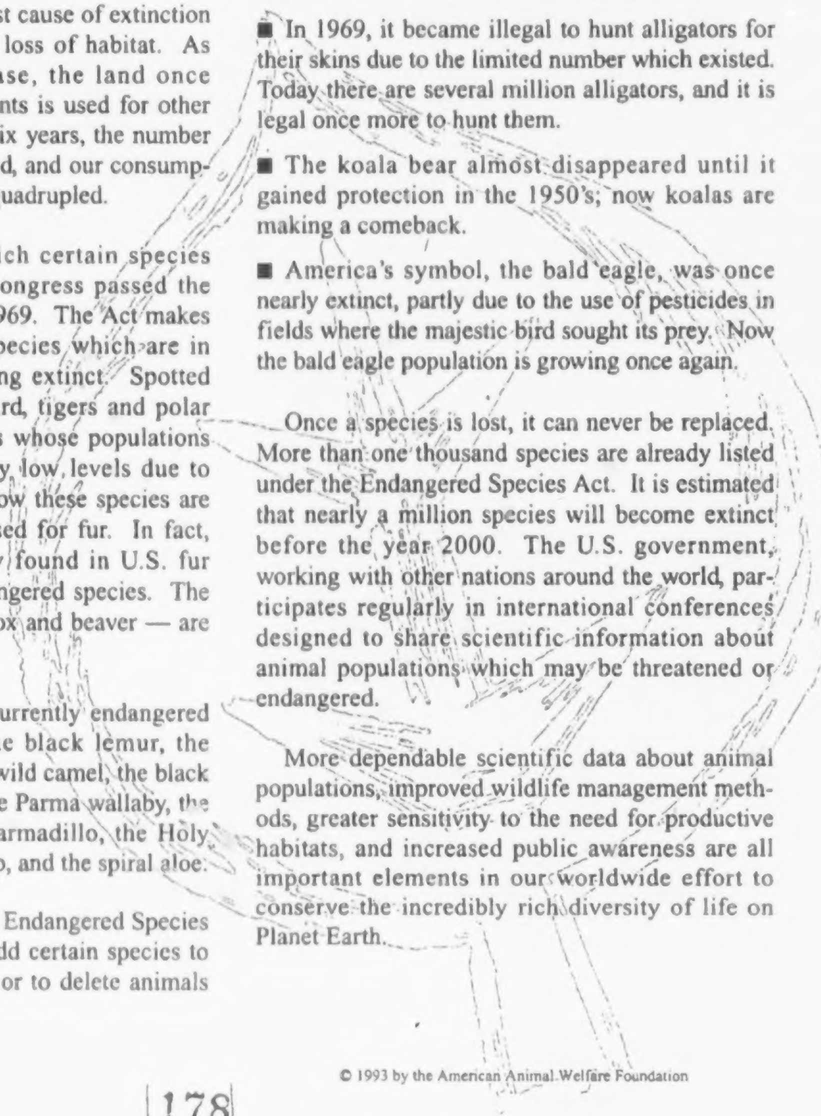
Conservation Society of America

D-4
MANAGING ENDANGERED SPECIES



Ever since life began on our planet, animal and plant species have been evolving and becoming extinct. Some species died out because of natural causes, such as changes in the earth's climate, drought, competition with new species, or volcanic eruptions. Other became extinct because they failed to adapt to their environment. In the past, such environmental changes occurred slowly, often over thousands of millions of years.

Today, however, the greatest cause of extinction of plants and animals is the loss of habitat. As human populations increase, the land once inhabited by animals and plants is used for other purposes. In the past thirty-six years, the number of people on earth has doubled, and our consumption of natural resources has quadrupled.

To limit the pace at which certain species become extinct, the U.S. Congress passed the Endangered Species Act in 1969. The Act makes it illegal to hunt and kill species which are in imminent danger of becoming extinct. Spotted cats such as the snow leopard, tigers and polar bears are among the animals whose populations were reduced to dangerously low levels due to excessive hunting for fur. Now these species are protected and may not be used for fur. In fact, none of the furs commonly found in U.S. fur stores today come from endangered species. The most popular furs — mink, fox and beaver — are more abundant than ever.

Other species which are currently endangered include the giant panda, the black lemur, the ivory-billed woodpecker, the wild camel, the black rhinoceros, the blue whale, the Parma wallaby, the mountain gorilla, the giant armadillo, the Holy Ghost orchid, the Venus flytrap, and the spiral aloe.

Periodic adjustments to the Endangered Species Act allow policy makers to add certain species to the list of protected animals, or to delete animals whose populations have been restored through careful wildlife management.

Wildlife managers and natural scientists have had remarkable success at bringing many species back from the verge of extinction. For example:

- In 1944, there were only 21 whooping cranes left. The U.S. government set aside land for them, and now there are over 200 whooping cranes.
- In 1969, it became illegal to hunt alligators for their skins due to the limited number which existed. Today there are several million alligators, and it is legal once more to hunt them.
- The koala bear almost disappeared until it gained protection in the 1950's; now koalas are making a comeback.
- America's symbol, the bald eagle, was once nearly extinct, partly due to the use of pesticides in fields where the majestic bird sought its prey. Now the bald eagle population is growing once again.

Once a species is lost, it can never be replaced. More than one thousand species are already listed under the Endangered Species Act. It is estimated that nearly a million species will become extinct before the year 2000. The U.S. government, working with other nations around the world, participates regularly in international conferences designed to share scientific information about animal populations which may be threatened or endangered.

More dependable scientific data about animal populations, improved wildlife management methods, greater sensitivity to the need for productive habitats, and increased public awareness are all important elements in our worldwide effort to conserve the incredibly rich diversity of life on Planet Earth.

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Conservation Society of America

D-5

THE IMPORTANCE OF HABITAT

A habitat is a place where an animal or plant is normally found. Rain forests, evergreen forests, grasslands, mountains, oceans and deserts are all unique habitats. The animals which live in those environments have adapted to them over thousands of years. When human intervention alters their habitats dramatically over a relatively short period of time, animals are often unable to adapt quickly enough to survive the changes. For that reason, the greatest cause of extinction of plants and animals is the loss of habitat.

Whooping cranes, for instance, became endangered when their marshy homes disappeared in the wake of urban development. Animals such as the giant armadillo, the wooly spider monkey, and the mountain gorilla became endangered when the mountainous rain forests they inhabited gave way to timber cutting.

Also, soil and water pollution has killed many species. When birds eat insects poisoned by pesticides, the birds are poisoned too. When chemical fertilizers wash into lakes and streams at excessive levels, fish die. When sea turtles eat plastic litter in the ocean, they die. Acid rain has caused many delicate wildflowers to become endangered.

Habitat can also be affected by the introduction of non-native species or sudden shifts in the balance between species. For example, Eurasian watermilfoil is an organism which was introduced accidentally to North American lakes from Europe. Travelling from lake to lake on the bottom of boats, it can form thick strands of tangled stems underwater, crowding out important native water plants, consuming vital oxygen and eventually harming fish and waterfowl. In the bayous of Louisiana, huge populations of nutria, a mink-like creature, have eaten and destroyed wide areas of marshland vegetation which formerly supported a variety of plant and animal species.

For this reason, some conservation and sporting organizations have made habitat development their top priority. One national group, for instance, has devoted itself to the restoration of habitat for pheasants. A typical habitat restoration program includes elements of the following: nesting cover renovations, winter cover plantings of windbreaks and hedgerows, food plot establishments, wetland restorations and land acquisitions.

Habitat conservation programs like these, combined with conscientious wildlife management by state natural resource officials and responsible behavior by hunters, assure that populations of game and non-game animals remain at appropriate levels.

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The American Animal Agriculture Association

R-1

THE AMERICAN ANIMAL AGRICULTURE ASSOCIATION

As a member of the American Animal Agriculture Association (AAAA), you participate in a broad federation of organizations which promote the humane use of animals for food and clothing. The federation includes farmer and rancher associations, egg and poultry producers and others with an interest in animal agriculture.

Farming is more than a business for those who engage in it. Living close to animals and the land has brought you into close contact with a way of life few people are privileged to know. Your family has operated a farm for four generations. Working with your parents and grandparents on the farm has taught you important values such as accepting responsibility, sharing work, learning from experience and respecting the rights of others.

You have chosen a career in agriculture because you love animals and enjoy working with them on the farm. Although you are strongly committed to humane treatment, you disagree with the animal rights view that "animals are not ours to eat, wear or experiment on." You agree with the American Veterinary Medical Association, which defines animal welfare as "...a human responsibility," encompassing all basic aspects of animal care. As the 18th century philosopher David Hume wrote in his *Enquiry Concerning the Principles of Morals,* humans are "bound by laws of humanity to give gentle usage to these creatures."

In 1906, American author Upton Sinclair published *The Jungle,* which exposed cruel and unhealthy practices at turn-of-the-century stockyards. Since that time, government and the agriculture industry have worked together to make meat production more humane and healthier for consumers. Your organization and other farm groups have cooperated with federal, state and local officials to promote such programs.

Your organization has also actively encouraged self-regulation among animal industries, from beef and hog producers to wool and fur growers. Thanks to the efforts of groups like the AAAA, many production agriculture groups have adopted industry guidelines for humane care. Many farm groups also finance independent research into animal science, nutrition, genetics and animal behavior to assure that production practices are based on sound veterinary science and technical knowledge.

Despite your commitment to humane animal care, your farm and others have been targeted by animal rights groups which oppose the use of animals for food and clothing. You believe their view is unrealistic. After all, if we "liberate" all domesticated farm animals, what will happen to them? How would cows or pigs or sheep survive in the wild after centuries of domestication? Would these species ultimately become extinct? Does it make sense to promote the extinction of domestic species while fighting to preserve threatened or endangered wildlife species? If we stop eating meat and release all farm animals, we will need to plant many more acres of crops to provide necessary food. How will we control the insects and pests which often destroy such crops? If killing animals for food is unethical, how can we justify killing the creatures which threaten our food crops?

It's clear that there are no easy answers to these questions. But if we cannot live without making use of other animals, you believe we have an ethical obligation to take responsibility for their humane treatment.

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The American Animal Agriculture Association

D-1

THE EVOLUTION OF AGRICULTURE

For centuries, scientists believed that humans "tamed" animals. But modern experts now theorize that domestication was really an inevitable process that occurred because it was of benefit to both human and animal species. Scientists believe that the process began over twelve thousand years ago, when wolves began to gravitate to the campfires which warmed ancient humans. Instinctively, the animals recognized that associating with people increased their chances of survival, ultimately enhancing their ability to reproduce. Their food supply was assured, so they didn't have to compete with other predators to eat. The campfires kept them warm, reducing their own need to expend energy for that purpose. And man protected them from savage attacks by other predators. As writer Stephen Budiansky observed, "Some remarkable and beautiful forces of nature were at work in producing the interdependence of man and animals, an interdependence that has eliminated much of the suffering and brutality of the wild."

No living creature can survive without other creatures; people must eat to survive. In prehistoric times, our ability to produce food was limited by primitive technology, modest skill and dependence on human labor as the major source of energy. Food was obtained largely by hunting wild game and gathering the fruits, nuts, roots and berries which grew uncultivated in nature.

Then about 5,000 years ago, there occurred an agricultural revolution that set the stage for the evolution of modern civilization. Beginning in the Middle East, in what is now Iraq, humans began the systematic raising of animals and plants for food and clothing. Agriculture soon became the essential ingredient for prosperity and development in the ancient world.

Still, at that time, it took vast numbers of people working on the land in order to provide the food needed by the small minority who lived in towns and villages. As time passed, the farmer had to produce progressively larger quantities of goods to meet the needs of a growing urban population, as rural citizens moved to cities and towns. This shift from an agrarian to an urban society is nowhere more evident than in the United States.

As our urban population has grown, fewer and fewer people have remained on farms to produce the food required by our nation. In the early years of this century, about two of every five people lived on farms. Today, only one out of fifty people lives on farms. That means that each U.S. farmer produces enough to feed forty-nine other Americans and still have plenty left over to sell abroad. Fewer than 3% of our population feeds the other 97% of us. If efficiency is a hallmark of the twentieth-century economy, then modern farms are a place where efficiency has been practiced, though rarely acknowledged.

Contrary to popular myth, the family farm continues to be the mainstay of American agriculture. More than 97% of the farms in the U.S. are owned by an individual or married couple, or are partnerships which include parents and children or close relatives. Although more efficient production methods have helped keep food and fiber affordable for consumers, technology will never be a substitute for the hands-on care and commitment that farm families bring to their work.

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D-2
AGRICULTURE AND THE ECONOMY

In the 19th century, America was an agrarian (rural) society. Today, 97% of our population lives in cities. Approximately 3% of our people produce the food which nourishes our entire nation. In 1900, one farmer could feed five people besides himself. Today, each American farmer produces enough to feed more than ninety other people.

Nearly 3,500,000 people are employed in farm occupations, generating more than $90 billion in national income. Farming also contributes positively to our nation's balance of payments. In 1991, we exported $39 billion in agricultural commodities, and imported only $22 billion, resulting in a positive trade balance for the U.S. Agricultural commodities account for about 10% of America's total exports. The positive trade balance generated by agricultural exports is important, because in many other areas, America imports more than it exports. In 1991, total U.S. exports of $421 billion were offset by imports of $487 billion, resulting in a trade deficit.*

Following are some of the agricultural commodities exported by the U.S:

COMMODITY	EXPORTS IN MILLIONS OF DOLLARS
Animal Feeds	3,192
Corn	5,145
Cotton (raw and linters)	2,514
Dairy products; eggs	454
Fur pelts	106
Grains, unmilled	701
Animal hides and skins	1,276
Meats and preparations	3,629
Animal oils and fats	446
Rice	753
Seeds	273
Soybeans	3,994
Tobacco	1,429
Wheat	3,350

*From 1993 *World Almanac and Book of Facts*

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The American Animal Agriculture Association

D-3

THE CASE FOR EATING MEAT

From prehistoric times, humans have depended on meat for the essential nutrients necessary for survival. We benefit from meat's nutrients because animal tissue is easily digestible. Although other foods contain important nutrients as well, our bodies cannot always digest them easily. Meat contains most of the things human beings require to live. It has all ten of the critical amino acids needed for human life. Its proteins are complete. It provides all the minerals we require, except for calcium, which we can obtain from dairy products. Even the fat in meat, consumed in reasonable quantities, is important and desirable because it gives over twice as much energy as carbohydrates.

Eating meat is efficient in other ways as well. A great deal of the land around the world cannot be used for growing crops. Even some arable land is inadequate to grow crops that people can eat. About one-third of the agricultural land on earth, and 44% of the U.S. land area, can produce only grasses and coarse vegetation. People cannot digest such grasses, but cattle, sheep, goats and deer can. At least 80% to 85% of the nutrients consumed by cattle come from non-grain sources — feedstuffs not edible by humans. By grazing cattle on this non-tillable land, we effectively harvest food and give economic value to the thousands of acres of land that is too rough to farm.

The ability of grazing animals to convert grasses into food for human consumption has been a crucial factor in the development of human civilization. Learning to herd animals that once were wild and became domesticated was a major step in transforming humans from small bands of roaming hunters into members of modern society.

Today we do not eat as much meat as our ancestors did. While meat made up about 70% of the diet of prehistoric humans, today we prefer more balanced fare. Thanks to modern technology, farmers have learned how to produce meat which satisfies the needs of modern consumers with rapidly changing lifestyles. Pork producers, for example, have devised ways to produce 50% leaner pork by modifying animal diets to reduce fat content. Beef producers have made a similar effort; the beef sold at retail today is 27% leaner than in 1986.

Although vegetarian diets remain popular with about 10% of Americans, the average American still consumes on average about twice their body weight annually in animal food products. Well-informed consumers and health professionals recognize that meat, with its high nutrient density, is an essential part of a balanced diet. It is an important source of protein, iron, B-vitamins and zinc.

Beyond nutrition, meat products have additional productive value. Beef and pork byproducts enable us to use 99% of every animal. These byproducts are key ingredients in a wide array of the products we depend on every day — everything from sausage casings and chewing gum to marshmallows, candles, paint, floor wax, pet foods and photographic film.

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D-4

RAISING SHEEP FOR FOOD AND FIBER

The nation's wool and lamb industries bring earnings and stability to many rural communities. The unique ability of sheep producers to provide high-quality meat as well as warm, durable wool makes them important sources of both food and fiber for our nation.

The use of wool dates back at least 10,000 years to central Asia, where people began to raise sheep for food and clothing. The art of spinning wool into yarn arose about 4,000 years ago in lands close to the Mediterranean Sea. In the early 1500's, Spanish explorers introduced sheep into North America, and by the mid-1700's — despite British opposition — the spinning and weaving of wool flourished in the American colonies. Spain sold the first merino sheep to the United States, and these animals were bred with the descendants of the sheep that had earlier been brought from England.

Sheep are among the most versatile of animals, living in a wide variety of climates and eating various vegetation. They can efficiently convert almost any available feed, grazing anywhere from the high desert to high mountain pastures. Their grazing habits make them useful from an environmental standpoint, since they help to establish and maintain forage for wildlife.

As a natural renewable resource, pure wool is a superior alternative to synthetic substitutes, which are usually made of petroleum, depleting our non-renewable resources and bringing other environmental consequences. The wool provided by sheep is one of nature's most remarkable natural fibers. Its superior wearing ability and insulating value, combined with its ability to absorb moisture without feeling damp, make it indispensable in cold, wet weather.

Although our nation ranks 10th in the world in wool production (Australia, the former Soviet Union and New Zealand are the major producers), the woolen industry remains an important part of U.S. agriculture. While production is scattered throughout the U.S., 80% of the sheep raised in the U.S. are produced in 17 western states. About three-quarters of the producer's income comes from meat, while the remainder is generated from wool. This makes the American sheep industry unique in the world, where wool is considered the primary commodity of the industry.

In 1990, 5.4 million head of sheep were processed in the U.S. and destined for supermarkets and restaurants nationwide. The meat provided by sheep is high in protein and rich in the minerals needed to maintain strong human bodies. Consumer demand for lamb remains high because so many different cuts and varieties of the meat are available.

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D-5

POULTRY FARMING TODAY

Since chicken and turkey are exceptionally nutritional, they have become increasingly popular with health-conscious consumers. Experts predict that per capita consumption of chicken in the U.S. will increase by as much as 20% over the next five years. As for turkey, per capita consumption has skyrocketed from 10.4 pounds in 1980 to nearly 18 pounds today. A valuable source of iron, poultry is low in calories, fat, cholesterol and sodium, and high in protein.

Broiler chickens, which are raised primarily as food, are among the most efficient producers of meat protein. To maximize this efficiency, feeds are specially mixed to strict nutritional specifications. The broiler is able to convert less than two pounds of feed into one pound of meat. Mature breeder chickens are placed in specially designed housing to facilitate the production and collection of fertile eggs. The eggs are placed in special hatcheries which turn them and control temperature and humidity, simulating the activity of the hen.

Laying hens are housed in pens to ensure that each bird has access to the proper amount of feed and water. A comfortable, well-ventilated environment is imperative if laying hens are to produce properly. Modern laying units are computerized to control ventilation, temperature, feeding and lighting. Hens have constant access to fresh air, feed and water.

Turkeys are raised in specially engineered barns or in wide-open "range" operations. In either case, turkey growers make numerous daily checks of each production location to assure the health of the birds. Technology provides additional tools for quality animal care. New computerized systems are used in some barns to monitor and adjust conditions in the building. Some barns are fitted with special cooling systems.

Although some people feel that raising chickens and turkeys in wide-open "range" conditions is more humane, the fact is that birds raised under such conditions often have a difficult time. Housing protects animals from predators, disease and bad weather. Housing also assures that each bird will have proper access to food and water, reduces the stress of breeding and birth, protects younger animals, and makes it easier for farmers to care for sick animals and prevent the spread of disease. Research is continuing into the differences between animals raised under "free-range" conditions and those raised in controlled housing.

While technology has made chicken and turkey production more efficient than ever, the human element still plays a vital role. Experienced poultry farmers have a unique relationship with their birds, often reflected in an uncanny ability to sense when something isn't right. That special knack allows farmers to make decisions that ensure the best possible environment for their animals.

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The American Animal Agriculture Association

D-6

THE VALUE OF LEATHER AND FUR

Since the beginning of recorded time, humans have relied on the skins of animals to clothe themselves. Prehistoric people used simple means, compared to today's sophisticated production methods. Still, furs, boots, belts and saddlebags have been part of human culture for centuries.

Most raw materials for leather goods are by-products of the meat-packing industry. Common hides, including those from cows, goats, horses, pigs and deer are most often used, but more exotic creatures such as the snake, alligator, kangaroo and walrus are also used.

Although wild fur was once the driving force behind the exploration and settlement of North America, the majority of furs sold today are raised on farms specifically for use in the clothing industry. Fur farmers in the U.S. have adopted high standards of animal welfare through a self-regulatory program which calls for independent veterinary inspection of fur farms. The excellent care which results from this program is largely responsible for the reputation American fur has earned as the finest in the world. As any farmer knows, it is virtually impossible to produce a high-quality animal product without providing the best possible care for the animals involved.

Wild fur continues to be popular as well. Most wild fur sold at retail in North America is harvested under strict controls enforced by state and provincial wildlife agencies in the U.S. and Canada. While some people believe that any harvesting of wild animals upsets the natural balance, the truth is that wildlife habitats can only support a limited number of any given species at one time. The number of animals which can be supported is known as the "carrying capacity" of that environment. Under controlled conditions, hunters and trappers harvest those animals which are surplus to the carrying capacity of their environment, restoring proper balance and assuring that habitats are not threatened by over-population of one species or another.

None of the furs typically sold at retail in the U.S. come from endangered species. In fact, it is illegal under federal law to kill or sell furs from endangered species. Many nations including the U.S. participate in international conferences held for the purpose of identifying threatened or endangered species, and limiting or prohibiting trade in products derived from them.

If we are to protect wildlife and habitat, we must make the use of animals and lands economically valuable. Without such economic forces, it becomes a lot easier to write these areas off for mining, oil and gas explorations, or other industrial purposes.

Leather and fur were once considered luxury products reserved for the very wealthy. Today, however, abundant supplies and low prices have made fur and leather available to many middle-income consumers, who enjoy these animal products for their beauty, warmth and durability — the same qualities which attracted our ancestors to them thousands of years ago.

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Americans for Medical Advances

R-1

AMERICANS FOR MEDICAL ADVANCES

Americans for Medical Advances is a broad-based coalition of groups and individuals interested in maintaining and promoting animal research. Your members include both health professionals —doctors, scientists and veterinarians — and ordinary people who wish to support medical research using animals.

You agree with the need to ensure that research animals are treated well and humanely. You have supported federal laws to establish guidelines for the proper care of laboratory animals. Your organization has supported efforts by your local university to reduce the use of animals in medical experiments, and you have called upon other research facilities to follow the same example.

At the same time, you believe strongly that animals must continue to be used for some purposes. Only in this way can new drugs and other treatments be tested and perfected before being used on human beings or animals. Animal testing is also important to assure the safety of consumer products including food additives, household products, toiletries and cosmetics.

Most important, you believe that animal research is essential to learning about disease and ways to cure it. You agree with former U.S. Surgeon General C. Everett Koop, who has said, "Virtually every major medical advance for both humans and animals has been achieved through biomedical research by using animal models to study and find a cure for disease, and through animal testing to prove the safety and efficacy of a new treatment. Without the use of animals in research, continued medical milestones will be stifled."

You know that animals also benefit from knowledge gained through biomedical research. Most of the techniques and treatments used in veterinary medicine have been adapted from human medical or surgical practice originally based on animal research. Medications to kill parasites and vaccines against rabies, feline leukemia, distemper and hepatitis have been developed using animal research. New surgical techniques, radiation therapy, chemotherapy, cryosurgery and hyperthermia have helped many pets live longer.

Wild animals have also benefitted from animal research. Many endangered species such as the bald eagle, alligator, red wolf and Florida panther have been saved as a result of animal research in reproduction, nutrition, toxicology and medicine.

You are especially concerned that animal rights groups may succeed in pressuring Congress to enact new restrictions which will make it impossible for researchers to conduct necessary experiments to find cures for cancer, AIDS, Alzheimer's, Sudden Infant Death Syndrome and other illnesses. To head off those initiatives, your organization has launched a massive publicity campaign to educate the public about the importance to human and animal health of continued animal research.

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Americans for
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D-1

SCIENCE AND ETHICS: THE ETERNAL DILEMMA

The heated debate over the use of animals in biomedical research is based on an eternal dilemma — the age-old conflict between that which *can* be done, thanks to modern technology, and that which *should* be done, based on our own system of values and ethics. In the case of medical research using animals, the issue can be defined in one question. Do the benefits to humans of animal research outweigh the cost to animals?

Some people say "no." Animal rights leader Ingrid Newkirk, founder of People for the Ethical Treatment of Animals (PeTA) has said, "There is no rational basis for saying that a human being has special rights. A rat is a pig is a dog is a boy." Animal rights philosopher Tom Regan has said, "Animal research is immoral even if it is essential... if abandoning medical research means that there are some things we cannot learn, then so be it."

Other people disagree. For people who believe that human beings have a special value apart from animals, there is no question that limited numbers of animals must be sacrificed to alleviate human suffering and pain. According to the American Medical Association, a majority of Americans support the use of animals in biomedical research because they recognize the essential relationship between biomedical research and medical progress.

Take the case of polio. In the mid-1950's, at least 30,000 people in North America and Europe died or were paralyzed each year from this disease. As a result of experiments on primates (monkeys), a polio vaccine was developed. Today, there are over a million people alive and well who would otherwise be dead or paralyzed. To develop the vaccine, about 25,000 animals were used.

But what about research that does not result in dramatic new discoveries? The sensational story of the great discovery which will cure a dread disease is almost always the last chapter in a long story. Progress in medicine, like any science, is slow, each breakthrough built on the knowledge accumulated over the past. Many important findings have come only after repeated repetition of previous experiments to validate earlier conclusions. Some of medicine's most important discoveries were made accidentally, as scientists sought something else — "serendipity," in scientific terms.

It's important to note that humans aren't the only beneficiaries of such research. Most of the techniques, treatments and vaccines that veterinarians use to save animals have been adapted from human medical or surgical practices originally developed through animal research.

While these activities may seem "unnecessary" to observers, they are in reality the building blocks upon which medical progress is based. If we value human life and seek to alleviate pain and suffering, we may have to accept that the responsible, humane use of animals in biomedical research means a better quality of life and longer life expectancy for human beings.

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Americans for Medical Advances

D-2

THE BENEFITS OF ANIMAL RESEARCH

Animals are used in specific experiments which have led, and continue to lead, to important breakthroughs in the diagnosis and treatment of disease. According to the Foundation for Biomedical Research, a Washington, D.C.-based research advocacy organization, medical advances using animal models have been dramatic over the last century. Improved treatments for the three major killers — heart disease, cancer and diabetes — have been made possible through animal research. More than 90% of the animals used in such research are rodents.

Childhood diseases such as rubella and whooping cough have all but disappeared due to vaccines developed through animal research. Jonas Salk's polio vaccine, developed in 1953 using monkeys, has virtually eradicated polio. Animal research led to the discovery of penicillin and other antibiotics, and to the development of vaccines for diphtheria, tuberculosis, measles and influenza.

Currently, there is promising work on the development of an AIDS vaccine using primates. Cats are being used to explore the cause of Sudden Infant Death Syndrome. Research on primates has uncovered an important characteristic of Alzheimer's Disease, paving the way for discovering its cause and developing potential treatments.

Following are some medical advances using animals as models:

DISCOVERY	APPLICATION	ANIMAL(S) USED
Penicillin	Cure bacterial infection	Mice
Polio	Vaccine to prevent polio virus	Monkeys, mice
Cancer Treatments	Tumor study, study of hormonal treatments, and development of chemotherapy	Rats, rabbits, hens, monkeys, rodents
Tuberculosis Cure	Research led to cure	Cows, sheep
Insulin	Used to control diabetes	Dogs, rabbits, rats, mice
C.A.T. Scan	Proved diagnostics potential	Pigs
Organ Transplants	Rejection prevention, technique refinement	Mice, rats, rabbits, dogs
Heart Disease Treatments	Study of disease and treatment methods	Rats, dogs, cats, sheep, rabbits

Source: Foundation for Biomedical Research, Washington, D.C.

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D-3

ANIMALS IN PRODUCT TESTING

Throughout our daily lives we use dozens of different products. When ill, we are given drugs or subject to medical treatments. We use soaps, cosmetics and household products which contain a wide range of substances in varying combinations. Federal law requires that all products available to consumers be tested and found safe. In most cases, products have been proven safe through experiments with animals.

For many years, animal testing has been conducted to protect consumers against products that might cause anything from minor skin irritation to severe health disorders. In the past, most companies performed their own tests using animals, mostly rats, mice and rabbits. At one time, the LD-50 test, which measures standard toxicity, was a common research technique. In that test, a product is applied to animals until the minimum dose needed to kill 50% of the animals receiving it is established. However, the LD-50 test is rarely used any longer, in part because the vast majority of cosmetics now on the market contain ingredients which have already been tested for toxicity, or because alternatives to animal testing are used.

Although some products carry the label "not tested on animals," the label has more public relations value than scientific accuracy. The fact is that virtually all cosmetics contain ingredients which have, at one time or another, been tested on animals. Companies which advertise that their products have not been tested on animals are merely taking advantage of testing done by other companies in previous years.

While some people may view cosmetics and toiletries as "frivolous" and "unnecessary," using toxic or unsafe cosmetics can have serious and even tragic consequences. For example, testing mascara on animals might seem unnecessary, until a consumer loses her eyesight due to a toxic reaction. Also, it is important to note that many of the tests which are commonly used to determine the safety of drugs and cosmetics are also used to evaluate the safety of drugs and medications intended for application to the face or eye areas.

There is concern that opposition to animal testing may lead to excessively restrictive regulations which might make it impossible for researchers to protect the public from potentially toxic substances. Although the scientific community is working hard to develop alternatives to animal testing, the American Medical Association has said it's unlikely that such alternatives will ever completely eliminate the need for animal testing.

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D-4

ALTERNATIVES TO ANIMAL TESTING

There is broad agreement among medical experts and research scientists that it probably will never be possible to eliminate animal testing completely. But researchers have worked hard to find other alternatives where practical. In recent years, the scientific community has adopted a program called "the three R's" — refinement, reduction, replacement. Those terms refer to the conditions under which animals are to be used in experiments.

Refinement — means refining research techniques to minimize the discomfort suffered by animals in experiments that are deemed necessary.

Reduction — means reducing the number of animals to be used in medical experiments.

Replacement — means replacing animal models with alternatives whenever possible.

Computer modelling is one high-tech alternative to animal research in certain cases. Based on past experience with animal tests, computer programs have been designed to effectively model the responses of both humans and animals to specific conditions. However, this approach has one obvious limitation. Computers are only as useful as the data we can enter into them; therefore, our use of computer models can only utilize existing medical knowledge. Computers will never be able to generate new knowledge based on principles of human physiology not yet known.

Tissue and cell cultures are another alternative. To some extent, these models are useful as substitutes for whole animal testing. In addition to tissue and cell cultures, researchers are using membranes from chicken eggs, human placentas, and corneas from the eyes of animals already in processing plants.

Other new techniques include recombinant DNA, which can produce synthetic substances without the use of animals; a synthetic form of insulin has been developed using this method. Mathematical analysis, physical and chemical tests using gas-liquid chromatography and mass spectroscopy provide other promising research possibilities.

Federal law regulates the care of animals in research labs. At universities where animal experiments are conducted, scientific committees review each proposal for animal research to determine whether the data being sought are necessary and meaningful, and to assure that the project complies with federal regulations. Such research projects are fully reported and evaluated by the scientific community.

Few scientists wish to use animals in research. The cost and paperwork required to do so has escalated greatly under pressure from animal rights activists. But researchers recognize that the needed results cannot, at present, be obtained by other means. Although alternative models may yield valuable information, these procedures usually precede and complement findings obtained through animal research. In the view of most experts, they cannot replace them.

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Americans for Medical Advances

D-5

THE ECONOMIC BENEFITS OF BIOMEDICAL RESEARCH

The benefits of biomedical research using animals are generally described in life-and-death terms, because both human and animal lives are saved by such research. In 1992, Americans paid more than $656 billion for medical care. Some people say the cost would be even higher without medical research. According to Americans for Medical Progress, an organization which supports biomedical research, taxpayers save $13 in reduced medical costs and lost wages for every tax dollar spent on biomedical research.

The National Institutes of Health (NIH), a government-funded research organization, reports that every $1 spent on applied research and clinical trials saves $8 in treatment. In the case of the measles vaccine, which was developed through animal research, $11 has been saved for every dollar invested. A recent laser treatment developed at NIH for diabetic retinopathy, an eye disease, has returned $40 in treatment savings for every dollar spent on its development.

There are other examples of the payoff received when we find cures or improved treatments for illness. For example, before the introduction of the drug lithium, patients with manic depressive illness typically spent one-forth of their lives hospitalized, one in four patients with the illness committed suicide. Today, 80% of patients with manic depressive illness never require hospitalization, and patients maintained on lithium are no more at risk for suicide than individuals within the general population. The medication, moreover, is estimated to have saved some $12 billion in medical care costs in the twenty years of its use in the U.S.

There are economic implications to the research currently being conducted on AIDS and Alzheimer's disease as well. AIDS has become the sixth leading cause of premature death in the U.S. According to the Federal Centers for Disease Control, nearly 250,000 people in the U.S. were diagnosed with AIDS in 1992. About 87% were covered by private or government health insurance at a cost conservatively estimated at $50 billion dollars. Setting aside the tremendous human cost of this illness, imagine the financial savings to be realized if a cure were found.

Similarly, nearly 4,000,000 Americans suffer from Alzheimer's disease, a costly and debilitating illness most frequently associated with older Americans. It is estimated that 10% of all individuals over 65 years of age and as many as 50% of those over 85 are affected. Since many Alzheimer's victims require intensive care and constant supervision, especially in the advanced stages of the disease, they are often placed in nursing homes or direct care facilities, a very costly course of action. A cure or reliable treatment for Alzheimer's would not only save millions of dollars, but it would also contribute toward the emotional survival of the victims' families, many of whom are devastated by the illness and its consequences.

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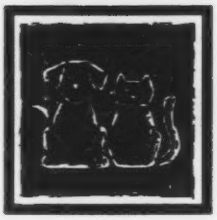
People and Animals in Partnership



R-1
PEOPLE AND ANIMALS IN PARTNERSHIP

For thousands of years, humans and animals have enjoyed a symbiotic (mutually beneficial) relationship based on the benefits provided by each to the other. People and Animals in Partnership is a loose coalition of organizations which focus on that unique relationship, and wish to preserve it.

Your organization includes pet owners and animal breeders, circus and zoo fans, racing associations, and those who work with special animals such as guide dogs. As a member of this group, you are strongly committed to humane care for animals. However, you believe that both humans and animals benefit from the various animal uses which bind them together. You disagree with those who say that animals have rights, including the right to live on their own without any intervention or assistance from humans.

The idea of rights is fairly modern. It dates back only a few centuries, and is often associated with the writings of John Locke (1630-1704). Its practical application to political life began in earnest with the Declaration of Independence in 1776.

Among the specific human rights that many societies now recognize are the rights of freedom of speech, religion, assembly, and others enumerated in the U.S. Constitution and the U.N. Declaration of Human Rights. Along with these rights come obligations. For example, we have the right to elect our leaders, but we have an obligation to obey the laws they pass. We have the right to enjoy private property, but the obligation to pay taxes. We have the right to free speech, but the obligation to speak responsibly in ways not slanderous or libelous.

It is this connection between rights and responsibilities which leads you to reject the notion of animal "rights." What is the other side of rights for animals? What obligation could they have? To be aware of our rights is to be rational and political — to be part of a social contract. How is it possible for animals to be part of such a contract?

If animals don't have "rights," then how do we address the issue of their treatment? The answer is simple. Animal welfare is a human responsibility — our obligation in return for the right to benefit from animal use. You believe that we must treat animals humanely — not because animals are our equal, but because our unique role as humans makes it incumbent upon us to do so.

You and your fellow group members believe that animals contribute to the social, economic and cultural life of our nation. Your goal as a member of People and Animals in Partnership is to ensure that genuine concern for animal welfare is not transformed into an extreme "animal rights" agenda which would put great distance between humans and animals, and do irrevocable damage to the bond that has existed between us for centuries.

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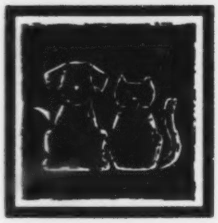
People and Animals in Partnership



D-1

THE IMPORTANCE OF HUMAN-ANIMAL INTERACTION

The keeping of animals as domestic pets is not a modern phenomenon. From the earliest days when wolves gravitated from the wild to the campfire, there has been a special bond between humans and their pets. Psychologists have confirmed that this relationship is important to the emotional health of human beings.

The American Pet Products Manufacturers Association reports that 58% of all U.S. households own a pet. That figure represents about 54 million American homes. Most have dogs or cats, but also owned as pets are birds, small animals (hamsters, rabbits, turtles, guinea pigs, mice, rats, gerbils), and fish. Many households own more than one pet.

For elderly people, just having a pet to hold and cuddle appears to have a remarkable effect on their well-being. Counselors working with AIDS patients have found that interaction with pets often helps to offset the isolation and feelings of abandonment suffered by victims of that terrible disease.

Child psychologists have found pets useful in the therapeutic treatment of disturbed children. Emotionally troubled children who experience animal interaction through horseback riding, pets, farm animals and wildlife rehabilitation programs feel more accepted by animals than people. For young people who lack self-esteem, the love of an animal enables them to open up, feel less defensive and more valued. Once communication barriers have been lowered and self-confidence raised, experts say children are more able to develop successful relationships with other people.

It isn't only disturbed children who benefit from interaction with animals. Educators have observed that average children learn more and develop better social skills when they are exposed to animals in the classroom. Integrating animals into curriculum in the language arts, math, science, social studies and geography stimulates student interest and fosters creativity and critical thinking.

Also, studies have shown that pets in the workplace improve productivity by relieving stress — petting an animal lowers blood pressure, reduces pulse rates, relaxes muscles, and makes people feel good. The Delta Society, an organization devoted to the study of human-animal interaction, reports that animals in the office create a friendlier atmosphere and make customers feel more comfortable. Although health and zoning laws may bar animals from certain work sites, others are flexible enough to permit introduction of dogs, cats or birds.

Animal rights groups have called for an end to pet ownership because "...dogs should be free to pursue their natural lives in the wild." PeTA's Ingrid Newkirk has called pet ownership "...an abysmal situation brought on by human manipulation." Even the Humane Society of the United States (HSUS) has gone on record opposing pet ownership ("Don't breed, don't buy, don't even accept giveaways"). Such positions don't contribute much to the strengthening of human-animal bonds.

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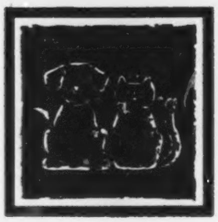
People and Animals in Partnership



D-2
DOGS WITH A MISSION

Although most dogs are kept by their owners for companionship, special dogs provide a range of special services to individuals and society. Included in this group are guide dogs which assist blind individuals, police dogs which assist law enforcement authorities in the detection of drugs and the identification and apprehension of criminals, and military dogs used to detect potentially fatal land mines buried underground.

Over 4,000 guide dogs are currently in use in the U.S. The main breeds used for this purpose are German shepherds, golden retrievers and Labrador retrievers. For over fifty years, these well-trained and deeply loyal dogs have made it possible for visually challenged people to move about freely and carry on a next-to-normal life without relying exclusively on the traditional white cane and the occasional assistance of passers-by.

Recently, certain dogs have been specially trained to assist individuals with physical disabilities other than blindness. These "service dogs" perform useful functions such as retrieving objects, operating light switches, helping to make transactions at banks and stores, and pulling wheelchairs when their human occupants get tired. The dogs also provide protection for their owners.

Law enforcement authorities rely heavily on police dogs to assist in their efforts. The acute hearing and olfactory (smell) senses possessed by dogs make them ideal candidates for locating and identifying criminals or victims. In addition, some dogs have been trained to smell narcotics and act as "alarms" when such substances are carried through airports or hidden in automobiles.

In the military, highly trained dogs use their sense of smell to detect buried land mines. Once a mine is detected by the dog, a handler marks the spot and demolition experts proceed to locate and disarm the explosive. These special animals have been extraordinarily successful at their job; not only have they saved thousands of human lives, but not a single dog has been lost in the process.

With all service dogs, the relationship between dog and handler becomes all-important. While most pet owners enjoy healthy relationships with their animals, the unique bond created between these "working" dogs and their owners is characterized by intense loyalty and an instinctive understanding of what is required of each. It would be tragic, indeed, if such partnerships were to be destroyed by those who feel that animals should live free of human contact or intervention.

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People and Animals in Partnership

D-3
ZOOS

Zoos are more properly known as zoological gardens. The first ones were constructed in Europe in the 18th century. The very first was the Imperial Menagerie established in Vienna in 1752, and opened to the public in 1765. Two of the most famous remain the Zoos of Paris, opened in 1793 in connection with the Botanical Gardens, and the London Zoo, which opened in 1828. The oldest zoo in the U.S. opened in New York's Central Park in 1864, while the National Zoo in Washington, D.C. was established in 1889.

Since the days of the Egyptian Pharaohs, people have enjoyed looking at exotic animals in all sorts of circumstances, from seeing trained animals in circuses to going on wilderness trips to see animals in their natural habitats. Wealthy and powerful people often kept collections of unusual animals; as mentioned earlier, some of those collections were the forerunners of today's modern zoos.

Zoos have traditionally served three purposes: public entertainment, popular education and scientific research. Modern zoos have expanded their roles beyond these three purposes. Many offer highly sophisticated veterinary facilities for the treatment of animals.

Natural scientists rely on zoos as environments in which to study animals and their behavior up close over extended periods of time. This study has led to important work in the area of endangered species. Zoologists are working to create opportunities for endangered species to breed in captivity, expanding animal populations and avoiding the threat of total extinction.

Since contemporary zoos are built to simulate the native habitat of the animals and provide them with the greatest possible freedom of movement, people can learn a great deal about various species from visiting them. And, since most zoos are public, non-profit organizations, they are open to all visitors for usually nominal fees. These factors make zoos an irresistible attraction for groups of school children seeking to learn about the animal world.

While some animal rights activists oppose zoos on the grounds that the animals are held "prisoner" against their will, it is almost impossible to overstate the contribution that these facilities make to our understanding of animals and the natural world. As the habitat for many species is being defiled and destroyed by modern society, the zoo is taking on a larger and more important role as the protector of the many species it contains.

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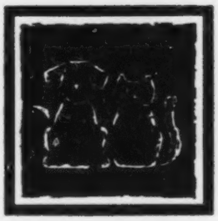
People and Animals in Partnership



D-4

ANIMALS IN EDUCATION

For millions of Americans, nature has become somewhat remote. Life on a farm is far removed from their lives, as is any experience with animals in the wilderness. This distance from nature can easily lead to indifference or misunderstanding about the natural world.

Much of the misunderstanding comes from the distorted images of animals seen in the media. Cartoons, for example, often feature animals made to seem almost human in their physical appearance. Babyish characteristics such as a relatively large head in proportion to the body, large and low-lying eyes, bulging cheeks, a large brain capsule in proportion to the face, and short, thick extremities are used to create a "cute," childlike look.

Often, cartoon animals are given the emotional characteristics of humans as well. Many Walt Disney cartoons and movies feature animals portrayed in very human ways. Bambi, Mickey Mouse, Donald Duck and Dumbo are a few examples. When human characteristics and emotions are attributed to animals, it is called "anthropomorphism." This technique, although frequently used in literature and entertainment, can cause problems. Anthropomorphism can confuse people, especially children, about what's real and what's not. The problem comes when the cartoon images become the dominant images of nature, and begin to substitute for the realities of nature in peoples' minds.

Just as cartoons create unreal images of "cute" animals, they create unreal images of "bad" animals. The Big Bad Wolf, Sylvester the Cat and Wiley Coyote are hapless but ultimately harmless cartoon villains. Unfortunately, children may not recognize that real wolves are dangerous to people as well as pigs, and that birds and mice seldom escape from their cat predators for long.

The only way to counter such illusions is to assure that children enjoy some direct encounters with the animal world. Many teachers are bringing animals into the classroom, or taking children out of the classroom on field trips, to assure that their knowledge of animals is based on something more substantive than Saturday morning cartoons. Field trips to farms, zoos, aquariums and nature preserves are all useful ways to learn about the animal world.

In addition, biology classes teach children about real animals. Dissection of frogs and worms help students understand the similarities and differences between animals and humans. While it is possible to learn biology from computer models, it is unlikely that computer models can teach children respect for animals in the same way that dissection does in a well-taught biology lesson.

In higher education and in medical and veterinary schools, the use of real animals is imperative. Who, after all, would want to be operated on by a doctor whose only experience in surgery was on a computer screen? Would you trust a veterinarian who had never diagnosed and treated live animals to see to your family pet?

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People and Animals in Partnership

D-5

THE HORSE YESTERDAY AND TODAY

The modern horse is a great example of how domestication has benefitted both humans and animals. Thousands of years ago, horses were all but extinct in Europe, while they thrived as a domesticated species in the Far East. When ancient traders began travelling and trading with horses, the species was revitalized in Europe and later brought to North America.

In addition to its importance as transportation, the horse played a pivotal role in warfare during previous centuries. But probably its most important role was as a working animal to be used for plowing and hauling the products of an agricultural society. Magnificent draft horses and versatile quarter horses all played important parts in the expansion of our modern economy.

The advent of the automobile rendered the horse all but obsolete as a means of transportation. The application of the internal combustion engine to farm work in the form of tractors, combines and other mechanized farm implements led to a reduction in the number and the relative importance of the horse as a factor in society's development.

Today, horses are seen mainly in a recreational role. Leisure riding and sport — from the racetrack and polo field to Olympic equestrian events — remain part of our culture. Very few horses are used as draft animals any more; instead, they lead more leisurely lives. Horse owners devote intensive attention to the animals they raise. Whether horses have been bred for riding or show, to assist with work or other purposes, conscientious owners take meticulous care to provide for the good health and comfort of their animals. Most horse owners have on-going relationships with veterinarians so that proper medical care, if required, is readily available.

The economic importance of the horse may have diminished overall but it is still significant. It is worth noting, for example, that the top thoroughbred race horse of the year in the U.S. has won more than one million dollars in prizes every year since 1979. Horse-racing is big business in many states, making the raising and training of horses a major factor in the agribusiness economy. Show riding and breeding continue to play both an economic and recreational role.

With the rapid urbanization of our country over the past one hundred years, habitat for wild horses has dramatically declined. As a result, the very existence of several species of horse would be in serious jeopardy were it not for their continued use in other than strictly working roles.

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People and Animals in Partnership

D-6
TOO MANY ANIMALS?

Statistics confirm that most Americans are animal lovers; 58% of American households own at least one pet. While the majority of pet owners are responsible, humane and conscientious, there are some who have failed to live up to their obligations. As a result, millions of homeless and abandoned animals are put to sleep in shelters each year, an unpleasant but regrettably necessary task. There is confusion, however, about the best way to address the pet overpopulation problem.

Some animal rights groups have proposed a ban on commercial pet breeding as one solution. However, this proposal fails to address the basic problem. Professional kennel operators breed pure-bred dogs in response to public demand for dogs with certain traits and characteristics. Very few purebred animals end up in pet shelters as unwanted or homeless animals. The vast majority of shelter animals are mixed breed strays and mongrels whose owners failed to have them spayed and neutered. Even if commercial breeding were to end tomorrow, the millions of dogs and cats given away at shelters across the country would continue to reproduce unless their owners took action to prevent it.

Some families want big, easy-going dogs that will be able to tolerate a great deal of handling by small children. Other families want small animals that are easy to train and don't shed. Since the traits and behaviors of pure-bred dogs are much more easily predicted than those of mixed-breed shelter animals, some people prefer to buy their pet of choice at a reputable pet store. Others prefer to purchase from a dog pound or shelter.

Regardless of where people purchase pets, it is important that they get as much information as possible about the animal's origin, medical history and temperament. But that's not where the pet owner's obligation ends.

In 1989, pet owners spent nearly $6 billion on dog and cat food alone. Some spend enormous amounts of money buying their pets all the toys and treats they can use. People who are concerned about animal welfare believe that some of these funds might be better spent on spaying and neutering. Such an effort might save the lives of countless animals.

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Additional Sources of Information

AGRICULTURE/GOVERNMENT

General
Science and Education Administration
United States Department of Agriculture
Room 217-W
14th Street and Independence Ave. SW
Washington, DC 20250

Statistics
National Agricultural Statistics Service
United States Department of Agriculture
Room 4133, South Building
14th and Independence Ave. SW
Washington, DC 20250

Food Safety
Animal and Plant Health Inspection Service (APHIS)
United States Department of Agriculture
Room 312-E
14th St. and Independence Ave. SW
Washington, DC 20250

Nutrition
Human Nutrition Center, Science and Education
Administration
United States Department of Agriculture
Room 330-A
Washington, DC 20250

Animal Care
Livestock and Veterinary Sciences
Beltsville Agricultural Research Centre
West Building 005
Chief's Office, Room 207
Beltsville, MD 20705

AGRICULTURE/INDUSTRY

American Farm Bureau Federation
225 Touhy Avenue
Park Ridge, IL 60068

National Livestock and Meat Board
444 N. Michigan Ave.
Chicago, IL 60611

ANIMAL RIGHTS

American Society for the Prevention
of Cruelty to Animals (ASPCA)
424 East 92nd Street
New York, New York 10128

Farm Animal Reform Movement (FARM)
PO Box 70123
Washington, DC 20088

Friends of Animals, Inc.
PO Box 1244
32 Haviland Street
South Norwalk, CT 06856

Humane Society of the United States (HSUS)
2100 L Street NW
Washington, DC 20037

People for the Ethical Treatment of Animals (PeTA)
4840 Wyaconda Road
Rockville, MD 20852

BIOMEDICAL RESEARCH

Americans for Medical Progress
Crystal Square Three
1735 Jefferson Davis Hwy
Suite 907
Arlington, VA 22202

Foundation for Biomedical Research
818 Connecticut Ave. NW, Suite 303
Washington, DC 20006

Office of U.S. Surgeon General
200 Independence Ave. SW
Washington, DC 20201

CONSERVATION AND WILDLIFE

Leopold Education Project
P.O. Box 75473
St. Paul, MN 55175

Project WILD
PO Box 18060
Boulder, CO 80308-8060

Wildlife Society
5410 Grosvenor Lane
Bethesda, MD 20814
Washington, DC 20005

PET OWNERSHIP

(Dogs)
American Professional Pet Distributors, Inc.
225 E. 6th St., Suite 230
St. Paul, MN 55101

(Other Pets)
Pet Industry Joint Advisory Council
1710 Rhode Island Ave. NW, 2nd Floor
Washington, DC 20036

ZOOS AND AQUARIUMS

American Association of Zoological Parks
and Aquariums
7970-D Old Georgetown Road
Bethesda, MD 20814

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Natural Resources
ROLE PLAYING

Resource
Conservation
Activity

CONSERVATION EDUCATION
TODAY & TOMORROW

Natural Resources Role Playing

SUGGESTED GRADE LEVELS: 7-12
SUBJECTS: Social Science, Science, Language Arts, Math
SKILLS: analysis, presentation, research, critical thinking, group process, lobbying, role playing, decision making, problem solving, communication, prediction, interpretation, comparison, data collection
CORRELATION TO STATE GOALS FOR LEARNING: Social Science (5), Science (2), Language Arts (1,2,3,4,6), Math (2)

Objective: Students will recognize the complex process of resolving conflicting positions and demonstrate how to negotiate.

Background: Construct a hypothetical public meeting to hear suggestions for addressing each of the six scenarios. Roles should be assigned to each student. Students should review the scenario, research the issues, introduce their personal interpretations and write a position paper. The public meeting should be composed of people representing the various conflicting viewpoints and the body of people qualified to make a decision on the issue (city council, county board, state or federal agency). A designated official should be selected to conduct the meeting. Participants may want to lobby audience members for support.

Points to Ponder: Stimulate in-depth review and discussion of positive and negative effects associated with each of the six scenarios. Remind students to address the "who-what-where-when-why" questions. Short-term and long-term impacts should be considered. Encourage consideration of the following points:

Ecological such as impacts of action on wildlife, habitat, endangered and threatened species, vegetative cover; water quality (siltation, runoff, chemical residue, topsoil loss); pollutants (air, water, land); ability and length of time required for ecosystem or impacted species to recover
Transportation System such as impact of flooding, increased heavy logging truck use on road system, delivery of goods and services
Economic such as project cost (cost-benefit analysis), tax base, short- and long-term benefits, tourism, loss of income, loss of services and impact on employment
Health and Safety such as impact of flooding on sewage or water treatment system, chemical discharge into water, citizen safety
Recreation such as increased hunting, fishing, trapping or camping opportunities
Public Relations such as coverage by media
Education of the Public such as actions to support tax increase, allow for public input, minimize nuisance wildlife

Potential Roles:
Resource Manager: As a resource manager my role is to maintain the greatest possible numbers and varieties of natural resources in a healthy state (animals, plants, rocks and minerals) continually while protecting the best interests of humans. Because humans have greatly impacted the balance of nature, management of resources is essential to maintain a stable and healthy population and prevent overpopulation and resulting starvation, disease and death. My management role includes selective timber harvest and replanting as well as the wise use of other natural resources for the benefit of society.

Lawyer: As a licensed attorney it is my responsibility to interpret and uphold the law while acting in the best interest of my client. Above all else, it is my duty to protect those whom I represent to the very best of my ability within the confines of the law. In order to fulfill my duty I must be willing to take unpopular positions. At times I argue against what may seem morally or ethically right. No matter how I personally feel about my client or the events to which they are tied, I will argue on their behalf. All information exchanged between my clients and me are strictly confidential.

Developer: As a developer it is my job to acquire land for the purpose of building structures for public or private use. This includes purchasing land and building commercial property such as shopping centers, food marts, retail or wholesale stores and public or private office buildings. I also purchase and develop land for housing such as single family homes, apartment buildings, condominiums and housing projects for elderly and low-income families. I must always think ahead to acquiring land because the need is so great and land is hard to come by, especially given all the restrictions from local, state and federal governments. Some parcels of land take years to acquire because they may have wetlands, threatened or endangered species or other restrictions preventing me from buying the land. This is frustrating because land is for humans to use and I shouldn't have to deal with all the extra headaches that government provides. My job is to get land and develop it while making as much profit as possible.

Environmentalist: Environmentalists have varying degrees of tolerance regarding consumptive uses of natural resources. Some of us are opposed to the taking or destruction of any of our natural resources. We feel it is our responsibility to do everything within our power to "preserve" all natural resources so they will remain for future generations to enjoy. Other environmentalists recognize and support the consumptive use of resources.

Taxpayer (public): As a taxpayer I expect an abundance of goods and services as well as prompt, courteous service. After all, I'm paying for it! It seems like our taxes are continually being raised. I'm not sure if we're getting anything in return. At times I question the need for government aid programs which simply give nonworking individuals food, clothing, shelter and money while I pay for it. I'm also bothered that taxes for utilities, property and schools are going up while, in my estimation, our educational system is much worse now than it was 20 years ago. I'm tired of paying for things that don't seem to be creating a better way of life for me. I demand accountability!

Government: As elected officials or employees of governmental agencies, it is our role to work in the best interests of the people who elected us. This means making sure that the public receives all benefits, goods and services to which they are entitled while ensuring that sufficient funds are available for these purposes. It is government's responsibility to protect citizens' rights and property while not infringing on their personal freedom of choice. It is also government's responsibility to protect public land for its intended use and provide for low-income citizens and those who cannot provide a basic existence for themselves. Local government must be the voice of the people. I must listen to the people and act upon their concerns.

Media: It is the responsibility of all media to keep citizens informed of events and decisions. All media must present accurate information. Timeliness is of utmost importance. I try not to choose sides or take a certain position when reporting information.

Business and Industry: Industry is what the U.S. was built on. We are the backbone of our industrialized economy. Given the fact that government has increased requirements such as clean air and water and pollution controls, businesses and industries are faced with expending large amounts of money just to keep functioning. This fact, coupled with a downturn in the economy and the need to pass on expenses to consumers, has caused a great deal of hardship and facility closures. The effect of industrial failure directly impacts people through loss of jobs and a slow economy. Jobs are being lost to competitors outside the U. S., and that fact alone should make government relax some of the requirements on industry. The bottom line is that industry is in business to make goods or provide services while remaining profitable. With the current situation, neither is happening.

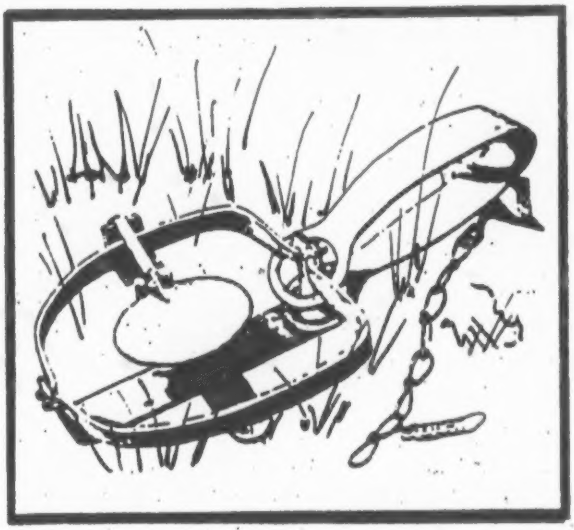
FLOOD

At stake is a 300-mile area along a major river that is prone to slight flooding. In the past, most flood problems have been handled on a local basis. The area includes 22 small to medium towns. A major hydro-electric power plant is within the area. It has been sandbagged several times by its 1,300 local employees to protect it from flooding. This plant provides electrical power for 12 communities and contributes heavily to the local tax base. The area school system is relying on the tax base to fund a large building project for a new school to serve three communities. Also on this river is a large cement plant, which produces a large portion of the cement used in major building projects in the U.S. and internationally. It employs 900 people and has also been flooded. One community recently spent $4.5 million creating a riverfront park which features three restaurants and two antique shops, each quite successful in attracting tourist trade. These and other businesses, large and small, make up the financial livelihood of these communities. Along the river are 380,000 acres in agricultural production supporting local farmers and the economy.

Late summer and fall rains have created severe flooding. Subsequent flooding of principal tributaries and smaller rivers downstream is posing potential damage and destruction to anything in its path. Disaster workers, law enforcement personnel and city fathers immediately take action to build levees along their towns. Volunteers are organized. Sandbags are trucked in.

However, there is strong opposition to the idea of levees from many of the business leaders in one of the larger communities. They believe that although levees have been built that seemed strong enough and high enough to repel the water, nature's force is often greater. Many levees have given way causing severe economic hardships. Business leaders feel their towns are being sacrificed when much of the water could be directed across farmland in the floodplain areas.

Potential Roles: U.S. Congressional Representative, state representatives and senators, mayor, city attorney, representative of Soil and Water Conservation District, engineer and biologist from Army Corps of Engineers, business owners, regional school superintendent, city engineer, environmental groups, media



HUNTING *and* TRAPPING

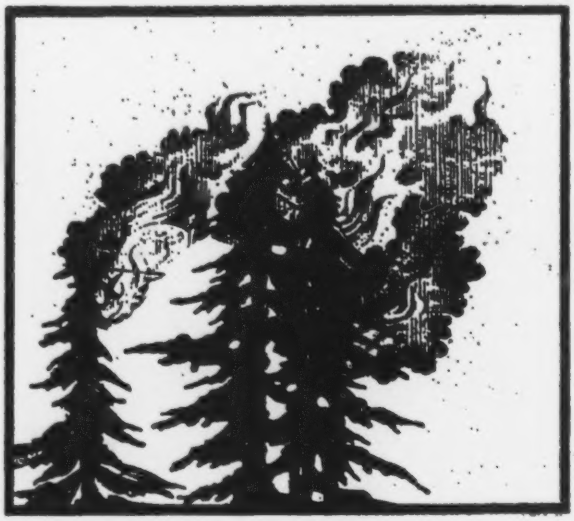
Pleasant Valley was established in the mid-1800s as a small farming community. The founders selected the site because the large forested valley provided wood for homes and was rich in wildlife. The surrounding rich, prairie soils produced abundant crops, and prairie grasses supported large herds of livestock. The Peaceful River flowed past the community and provided fish and waterfowl for the table and a means of shipping produce to Mega City. Plans were underway for a railroad line to run from Pleasant Valley to Mega City. The founders passed city ordinances to maintain vast portions of the forested area inside and surrounding the city. They recognized the value of the forest to provide shade, wildlife and a pleasant appearance. Mega City was a distant 30 miles from Pleasant Valley! The booming population relied on the meat, vegetables and corn produced by Pleasant Valley farmers.

Time passes. Mega City grows. Development creeps toward Pleasant Valley. The agricultural land surrounding Pleasant Valley is sold to make way for houses, businesses and industries. White-tailed deer feed on the vegetation of surrounding manicured yards, golf courses and parks. Beavers dam local streams causing localized flooding. Thinking they are helping, some people provide continuous sources of food for wildlife. The habitat can no longer support the wildlife populations, but with the unnatural sources of food, populations continue to grow.

People are complaining about deer browsing and killing their landscaped yards. The local garden center is losing thousands of dollars of plants each year to wildlife damage. The manager of the golf club receives an average of 10 complaints each week regarding the damage beaver make on the course. Police reports show the number of automobile accidents involving deer increasing significantly, including at least one fatal accident each year. A few instances of animal disease have been documented.

At a Pleasant Valley city council meeting, biologists recommend implementation of a hunting program to control the numbers of white-tailed deer and a trapping program to control the number of beaver. Some people attending the city council meeting stage a protest claiming that hunting and trapping are cruel to animals. Other people express concerns over human safety in areas where hunting is allowed and the safety of humans and pets where traps are set. Hunters and trappers in attendance support the proposal as it will provide recreational opportunities, meat and income from the sale of pelts. The owner of the garden center and manager of the golf course support any means of decreasing the wildlife damage incurred.

Potential Roles: city council member, biologist, animal activist, hunter, trapper, garden center owner, police officer, golf course manager, homeowner, mayor, environmental groups, media



FOREST FIRE

A retired couple were traveling through the Shawnee National Forest in their mobile home with their car in tow. The towed car blew a tire; however, it was impossible for the couple to see the blown tire due to the position of the mobile home. They continued, not knowing that the car was igniting forest fires along the road with sparks coming from the wheel. After several persons had passed signaling to them something was wrong with their car, they pulled over. The man used his fire extinguisher to put out the flames on the car.

The damage had already begun. Many small wild fires had been started. Numerous fire fighters were called in to help extinguish them. About one-third of the 300,000 acres in the Shawnee National Forest was burned. Many animals were displaced. Logging was halted placing 125 loggers out of work. Visitor attendance was low after the fires because many of the scenic picnic and camping areas were closed for safety reasons. Local cities felt the impact as tourism decreased and logging operations ceased.

Some resource management professionals argue that fire is a natural process that some species of trees (pines) and habitats require to maintain themselves. Prescribed fires are used to reduce the amount of litter that accumulates on the forest floor. As a management tool, prescribed fires are undertaken with considerable planning and training. An argument may be made that the ecological benefits of the forest fire outweigh the social repercussions.

The U.S. Forest Service decided to send a bill for the fire-fighting expenses and clean-up costs to the retired couple. The couple disagreed with the federal government, claiming the fire was an accident. They retained a lawyer and have taken the issue to court.

Potential Roles: lawyers, retired couple, representatives for the U.S. Forest Service, logging company, environmental groups, rural fire protection district, tourism and local cities

THE NEW MALL

The New Design Company is interested in developing a new mall in a suburban town near a large city. There are no large malls in the vicinity. The mall will provide approximately 1,500 new jobs. The proposed area is already zoned for commercial/business purposes. Usually when malls are built, other supplementary businesses come to the area. Because of the new tax revenue collected, more money will be available to schools. The mall will attract more tourism to the area and other businesses such as hotels, restaurants and gas stations will be patronized. Overall, a new mall will develop the image of the town as a place that people will want to visit, spending time and money.

The proposed mall will be built on land that is a wetland area about four months each year. Wetlands are being watched very closely because 89 percent of Illinois wetlands already have been eradicated. If the mall is built in this location, there must be some type of mitigation. In other words, if the wetland area is drained and filled to build the mall, the wetland must be replaced somewhere else, probably at a 1:1.5 ratio. If 100 acres are developed, 150 acres must be replaced. In addition, the proposed site is a known nesting site of the endangered yellow-headed blackbird.

Homeowners know the mall would result in increased traffic, congestion, noise and crime. They point out that police, emergency and fire services will have to be expanded. Downtown business owners feel that the mall will divert business away. If these businesses eventually fail, the result will be the deterioration of the downtown area and a weakening of the tax base.

Potential Roles: mayor, property owner near mall site, business owner in downtown area, biologist, Audubon Society member, Job Service/employment agency representative, prospective business owners in mall area, zoning board, developer, media

INDUSTRIAL AQUATIC POLLUTION

Crudbegone is home to 1,000 working adults. Four hundred Crudbegone residents are employed by the Weavit textile plant. Fifty workers are employed by Ketcham Fish which commercially fishes Lake Crudbegone. Fifty workers are employed by the Lake Crudbegone Marina which serves the recreational needs of several surrounding communities. Two hundred residents are engaged in farming. Half of the farmers irrigate their land from the waters of Lake Crudbegone, which also serves as the city water supply. Crudbegone's rural residents have private wells for drinking water.

The Weavit textile plant has been illegally dumping industrial effluent into the lake for five years. Current toxin levels place Weavit in violation of the Clean Water Act. Current pollution levels make the water unsafe for use as the city drinking water supply. Ketcham Fish has noticed a marked reduction in the number of fish in their haul. Consumer concern over the safety of eating fish from Lake Crudbegone has had a devastating effect on Ketcham's sales. The farmers are concerned about using the water to irrigate their crops but feel fortunate to have their own wells for drinking water. Some farmers are speculating that the contaminated water will harm yields, or worse yet, make them unsuitable for human consumption. Health officials have placed a temporary moratorium on all recreational activities on the lake, effectively putting the Lake Crudbegone Marina out of business. Ketcham has laid off its 45 fishermen, leaving only its management team in place. Only the manager of Lake Crudbegone Marina remains employed.

Weavit claims it can correct only 20 percent of the problem without incurring significant lay-offs. Weavit can correct 60 percent of the pollution if 300 employees are laid off. If more than 300 are laid off, Weavit claims it will not have enough production to finance cleanup. Weavit is requesting a special tax be placed on the people of Crudbegone to finance a portion of the cleanup. The tax will fall heavier on each individual as unemployment increases. Town residents are upset that though some farmers will benefit from having the lake cleaned, they will not be taxed because they are not within the Municipal Sanitation District.

It is thought that cleaning up 40 percent of the pollutants will make it safe for recreation and irrigation. Sixty percent will allow for the return of a healthy fish population. An 80 percent cleanup will be required to put the city's drinking water back on line. A high incidence of cancer has been noted for the community; however, no conclusive studies have linked it to the water system. The cancer rate is higher than surrounding communities that use different water systems.

The city council is meeting tonight to bring this situation to a resolution. They hope to solve as many of the problems as possible without increasing unemployment or taxation. Everything is on the table, from increased personal and corporate taxation, to legal action against Weavit (which would probably put it out of business).

Potential Roles: industry, physicians, biologists, marina owner, city residents, mayor, state and federal Environmental Protection Agency, environmental groups, fishermen, farmers, employees of industry, recreational users of lake

TIMBER

The Windfall Lumber Company wants to begin a controlled timber harvest of the Enchanted Trees National Forest. The company intends to create jobs for former miners in that area and use the profits of the lumber sale to help fund forest-related projects.

Windfall Lumber Company developed a multiple use plan for the forest with input from a wildlife biologist, a hydrologist, a recreation specialist, a soil conservationist, an engineer and many foresters. The lumber company expressed a desire to control the harvest, maintain the quality of the original forest, and implement an intermediate cutting and an improvement cut. The management plan took several months to produce. The management plan calls for a selective harvest of trees, using pre-existing access roads, priority hiring of former miners, and monitoring of water, soil, air and wildlife.

Selective improvement cutting is the harvest of a few trees, preferably the older mature trees and defective or diseased trees. Selective cutting can also be the harvest of one tree species (black walnut) in a area. Once the larger older trees are gone, younger trees have room to grow healthier. Up to five dead standing trees per acre will be left as den and nesting sites to benefit wildlife such as raccoons and woodpeckers. A few trees will be left on the ground to serve as nesting sites or hiding places for animals.

Local residents have mixed views about the proposed timber harvest. A team of local citizens has been trained to monitor the forest. Some arguments in support of the harvest include new jobs, more wildlife for hunting and a greater variety of plant species. Those against the harvest say that it will increase traffic on already heavily traveled roads, create pollution and damage the character of the forest.

A local environmental awareness group has been strongly opposed to the idea of a managed timber harvest since it was introduced in the state legislator's office. They argue that a controlled timber harvest is nonexistent in real life and that the harvest will destroy the last remaining virgin forest in the area. Another environmental group supports the idea of a managed timber harvest because it will improve wildlife habitat.

Many loggers oppose the plan to give hiring priority to former miners. The loggers are afraid that the inexperienced help will endanger the lives of other workers as well as themselves.
Suburban citizens living outside the Enchanted Trees National Forest complain that the forest is protected by their tax dollars and should be preserved. They believe the harvest will harm the forest and wildlife will be lost.

Potential Roles: two types of environmental groups, lumber company, biologist, forester, soil scientists, former miners, U.S. Forest Service, suburban citizens, legislators, media

Resource Conservation Activity

Environmental Timeline

SUGGESTED GRADE LEVELS: 7-12
SUBJECTS: Social Science, Science, Language Arts, Math
SKILLS: identification, research, discussion, interpretation, comparison, inference, prediction, data collection, communication, problem solving, decision making, graphing, analysis
CORRELATION TO STATE GOALS FOR LEARNING: Social Science (2), Science (1,2), Language Arts (1,2,3), Math (6)

Objective: Students will identify some major natural resource policies, laws, disturbances or disasters in the United States and describe the relationship of each to other historical occurrences.

Background: Events affecting the environment have occurred throughout history. Some events are natural while others are caused by humans. Events may be positive and serve to preserve, protect and enhance natural resources, while others are detrimental to habitat or wildlife resources.

Projects and Activities: Students will develop a timeline showing significant environmental occurrences in the history of Illinois and the United States. Historical items listed in the background section provide a basis for further research and discussion. Students should add other environmental events found during their research.

As a class or in small groups discuss what happened during the times when no environmental legislation occurred. Discuss how the economy and wars affected attitudes of the public and leaders. Add these to the timeline. Have students add an additional line showing the relationships of presidential terms to environmental events. Review the information on American Conservationists, Unit 4, and discuss how each may have influenced policies.

A.D. 1259-1294 - the first indication of game management practices for conservation are found by Marco Polo in the Mongolian Empire with the laws that Kublai Khan had established to protect rabbits, deer and large birds between March and October.

Native Americans, as a hunter-gatherer society, are immersed in and working with nature.

1600 - land that is to become Illinois encompasses 21 million acres of prairie in Illinois.

1600 - 14 million acres of forest in Illinois.

1607-1900 - frontier expands and resources used; abundant and seemingly inexhaustible supplies of timber, fertile soil, wildlife, water, minerals and other resources for their use and exportation to Europe; continent viewed as a hostile wilderness to be conquered, opened up, cleared and used as quickly as possible; attitude led to enormous resource waste and little regard for future resource needs.

1621 - Rock dove (pigeon) introduced to North America.

1682 - Robert Cavalier, Sieur de La Salle and Henri de Toni reach the mouth of the Mississippi River; later they build Fort St. Louis atop Starved Rock.

1693 - Joliet and Marquette cross Illinois.

Pre-1700 - French law prohibits felling of certain trees in forests when deemed there may be potential need for construction of forts.

1754-1763 - French and Indian War.

1775-1783 - American Revolution.

1787 - Congress passes the Ordinance of 1787 establishing the Northwest Territory. Illinois was one the five future states in the territory.

1797 - "Johnny Appleseed" or John Chapman plants his first seeds in the Ohio River Valley.

1807 - Thomas Jefferson established the National Oceanic and Atmospheric Administration (NOAA) to survey America's coastal resources.

1812-1815 - War of 1812.

1817 - Illinois legislature passed a measure to provide for damming the Kaskaskia River to construct a "fishery."

1818 - Illinois becomes the 21st state in the nation.

1831 - carp thought to be introduced to North America by a private citizen;

1877 - carp introduced by the U.S. Fish Commission.

1833 - Chicago is organized as a town; Native Americans induced to relinquish their last square-mile claim on Illinois.

1837 - John Deere improves the self-scouring steel plow; conversion of prairie to farmland begins.

1838 - 16,000 Cherokees moved to Oklahoma along the "Trail of Tears."

1839 - wapati (elk) uncommon to rare in Illinois.

1844 - great auk extinct.

1848 - I & M Canal completed in Illinois.

1850 - about 80% of total land area of U.S. is government owned; calling for responsible resource action were early conservationists - George Catlin, Horace Greeley, Ralph Waldo Emerson, Frederick Law Olmsted, Charles W. Eliot, Henry David Thoreau and George Perkins Marsh.

1850 - house sparrow introduced to North America.

1853 - first real game laws passed by the 19th Illinois General Assembly (deer, prairie chicken, quail, grouse and woodcock in counties of central and northern Illinois).

1855 - Illinois' game law extended to 44 counties and broadened to make it illegal to sell game during the closed season.

1855 - black bear rare to extirpated from Illinois.

1859 - Illinois provides protection for certain song birds; muskrat trapping prohibited in Cook County from May to October.

1861-1865 - Civil War - federal government turned attention to expanding frontier westward; displacing Native Americans and killing American bison.

1865 - timber wolves extirpated from Illinois.

1867 - trapping of otter, beaver, mink and muskrat prohibited in Cook County from May to October.

1870 - use of charcoal as fuel dramatically reduced.

1872 - U.S. government set aside more than 2 million acres of forest as the Nation's first National Park (Yellowstone National Park) and banned all hunting in the area.

1872 - Illinois legislature passed the first fish conservation law that prohibited the obstruction of the passage of fish in all waters within the State and placed a size limit on nets used for fishing.

1872 - Arbor Day established in Nebraska to encourage tree planting.

1875 - cougar (mountain lion) extirpated from Illinois.

1876 - Congress authorized the federal forestry office.

1877 - Illinois State Laboratory of Natural History formed in Normal.

1878 - first state game commissions formed in New Hampshire and California.

1879-1913 - the Illinois Fish Commission established and operational.

1881- ring-necked pheasant introduced to North America.

1883 - American Ornithologist Union organized as the first national scientific organization to take active interest in wildlife conservation.

1886 - Audubon Society organized.

1890 - starlings released in Central Park, New York City on March 6.

1891 - Congress passed Forest Reserve Act - set aside Yellowstone Timberland Reserve as first federal forest reserve; also authorized president to set aside additional federal lands to ensure future supplies of timber and to protect water resources.

1891 - first refuge for ducks established in Horicon Marsh, Wisconsin.

1891-1897 - Presidents Benjamin Harrison and Grover Cleveland withdrew large areas of public land, mostly in the west, from timber cutting.

1897 - the first game warden hired in Illinois.

1898 - Bureau of Forestry created (becomes U.S. Forest Service in 1905); first Forestry School established in the United States.

1899-1913 - the Illinois Game Commission established and operational.

1900 - more than half of public land was given away or sold at low cost to railroad, timber and mining companies, land developers, states, schools, universities and homesteaders. Artificially lower prices encouraged widespread waste and degradation of much of country's forests, grasslands and minerals.

1900 - Lacey Act (revised in 1976) - illegal to transport live or dead wild animals, or their parts across state borders without a federal permit; also illegal to import foreign wildlife without a government permit.

1900 - first National Audubon Society Christmas bird census conducted; annually conducted between Dec. 15 and Jan. 2 throughout the nation.

1900 - moratorium on hunting white-tailed deer in Illinois.

early 1900s - Carolina parakeet extinct.

1901 - American conservation split movement into two schools of thought in early century over proposed building of dam and flooding the Hetch Hetchy Valley to create a reservoir to supply San Francisco with drinking water.

preservationists - believed wilderness areas should be left untouched, led by naturalist John Muir.

utilitarian resource managers - believed wilderness and other public lands should be managed wisely to provide resources for the people led by Gifford Pinchot and San Francisco mayor James D. Phelan.

1903 - Illinois required a resident hunting license and declared it illegal to sell waterfowl killed in Illinois.

1903 - President Theodore Roosevelt established first federal wildlife refuge, Pelican Island off east coast of Florida, for preservation of endangered brown pelican.

1905 - Congress created United States Forest Service (USFS) to manage and protect forest reserves; Gifford Pinchot appointed first chief.

1907 - Illinois established a fur-taking season; first license required for the use of nets for seining purposes.

1908 - President Theodore Roosevelt called a meeting of state governments for 1910 which resulted in the creation of 41 new state conservation departments.

1908 - Fort Massac established as the first Illinois State Park.

1909 - laws enacted making it illegal in Illinois to bait ducks.

1910 - use of wood as a major fuel started to be replaced by coal, propane, natural gas and petroleum.

1911 - Illinois required nonresident hook and line fishing licenses.

1912 - Congress created U.S. National Park System.

1913 - Illinois Governor combined the separate fish and game commissions and created the Game and Fish Commission; first two fish hatcheries established (Spring Grove and Havana).

1914 - passenger pigeon extinct.

1915 - Illinois Game and Fish Commission purchased a special "State Fish Car" to distribute fish from the hatcheries via the railroads.

1916 - Congress passed the National Park System Organic Act - national parks are to be set aside to conserve and preserve scenery, wildlife and natural and historic objects for the use, observation, health and pleasure of people.

1917 - Illinois abolished the Game and Fish Commission and establishes a Division of Game and Fish under the Department of Agriculture; Illinois Natural History Survey formed.

1918 - Migratory Bird Treaty Act implemented for the protection of migratory birds.

1922 - Izaak Walton League formed in Chicago as a conservation organization.

1923 - Illinois required the first resident hook and line fishing licenses with monies deposited into a special Fish and Game Fund.

1924 - Illinois Department of Conservation established.

1924 - Noris Doxey/Clarke McNary Laws (state) allowed for wildfire protection programs and hiring of foresters to work with private landowners and enhancement of tree nurseries.

1927 - first Illinois State Forester appointed; eight fish hatcheries exist.

1929 - National Wildlife Refuge system created to provide protection for wildlife habitat, especially waterfowl.

1929 - stock market crashed in October.

1929 - beaver reintroduction began in Illinois.

1933 - Civilian Conservation Corps (CCC) created - 2 million unemployed young men hired to plant trees, develop parks and recreation areas, restore silted waterways, provide flood control, control soil erosion, protect wildlife and carry out other conservation projects.

1933 - President Roosevelt founded the Soil Erosion Service under Department of Agriculture to correct some of the enormous erosion problems that had ruined many of the farms of the Great Plains states and provide technical assistance to farmers; renamed Soil Conservation Service in 1935.

1934 - Migratory Bird Hunting and Conservation Stamp Act - required waterfowl hunters to possess a federal hunting stamp to attach to their state hunting license; since 1934 sale of stamps has brought in more than $300 million for waterfowl research and for purchasing waterfowl refuge lands; receipts from the sale are deposited in a special U.S. Treasury account known as the Migratory Bird Conservation Fund.

1934 - Taylor Grazing Act; beginning of regulation of grazing of domesticated livestock on public lands, especially in the west; imposed fees for use of lands and restricted numbers of animals that are allowed to graze.

1935 - April 14 called "Black Sunday" after an article written by Robert Geiger, Associated Press Reporter working for the Washington Evening Star, and the term "Dust Bowl" he coined for the disastrous wind erosion sweeping the Great Plains.

1937 - Federal Aid in Wildlife Restoration Act (or Pittman-Robertson Act) levied a federal tax on all sales of guns and ammunition; 11 percent excise tax with money returned to states based on the number of licensed hunters and the size of the state; used for hunter safety education programs, land acquisition and research; also provides federal aid to states for management and resortation of wildlife.

1939 - Shawnee National Forest established in proclamation by President F.D. Roosevelt.

1940 - U.S. Fish and Wildlife Service (USFWS) formed from two other offices and placed in the Department of the Interior - given roles of managing National Wildlife Refuge System and protecting wild species in danger of extinction.

1945 - U.S. Forest Service created Smokey Bear as a campaign against forest fires caused by carelessness.

1947 - Illinois Department of Conservation organized a statewide lake development program to build more lakes for sport fishing and other recreation.

1948 - Federal Water Pollution Control Act.

1950 - Federal Aid in Sport Fish Restoration Act (or Dingell-Johnson Act) - levied a 10% federal tax on fishing equipment; provided federal aid to states for management and restoration of sport fish in the marine and freshwaters of the United States.

1950 - hunting of white-tailed deer in Illinois allowed for the first time in 50 years.

1954 - giant Canada goose considered extinct; population found in 1962 in Rochester, Minnesota; recent population estimates in Illinois of over 106,000.

1959 - wild trapped turkeys from Mississippi, Arkansas and West Virginia released in sourthern Illinois to start the reintroduction program; stocking contined for many years, with the first Illinois turkey hunting season in 67 years opened in 1970.

1960 - Multiple Use and Sustained Yield Act - required the national forests be managed to provide the maximum benefit for the general public.

circa 1960 - minimum size limits established for lake trout (1.5 pounds) and whitefish (2 pounds) in Lake Michigan.

1962 - Rachel Carson's book *Silent Spring* published.

1963 - federal legislation passed requiring a study of air pollution; established federal standards for various pollutants from both stationary and mobile sources to prevent deteriation of air quality and improve air quality where federal standards are not met.

1963 - Illinois Natural Areas Preservation Act - passed to provide protection to unique and pristine habitats.

1964 - Land and Water Conservation Act - revenues from admission fees to publicly owned land and federal oil leases used to acquire lands and waters having scenic, recreational or other value.

1964 - Wilderness Act - to protect undeveloped tracts of public land as part of National Wilderness Preservation System.

1965 - Water Quality Act - legislation passed requiring a study of water pollution.

1967 - the bald eagle listed as an endangered species in the lower 48 states and Canada.

1967 - laws passed to make it unlawful to take lake trout, coho salman or chinook salmon from Lake Michigan.

1968 - Wild and Scenic Rivers Act - allowed rivers and river segments with outstanding scenic, recreational, geological, wildlife, historical or cultural values to be protected. Rivers are classified as wild, scenic or recreational. Activities allowed include camping, swimming, non-motorized boating, sport hunting, and sport and commercial fishing. New mining claims permitted in some areas.

1969 - National Environmental Policy Act (NEPA) - required a comprehensive evaluation of the environmental impact of an activity before it is undertaken; all federal agencies must respond to the same policy to address environmental issues; established a Council of Environmental Quality; EIS (Environmental Impact Statement) process established to disclose effects of actions on the environment, propose alternative actions and describe environmental consequences.

1969 - the peregrine falcon listed as an endangered species.

1970 - Clean Air Act - using the information collected in the 1963 study on air pollution, legislation passed to set ambient air quality standards for criteria air pollutants.

1970 - first annual Earth Day celebrated in the United States on April 22; 20 million people in more than 2,000 communities demanded better environmental quality; between 1969 and 1980 Congress passed more than 24 pieces of legislation to help protect air, water, land and wildlife.

1971 - Woodsy Owl introduced by the U.S. Forest Service as an antipollution symbol.

1972 (1987) - Clean Water Act - to restore and maintain the chemical, physical and biological integrity of the nation's waters; regulations and programs developed by U.S. Environmental Protection Agency to reduce the quantity and toxicity of pollutants entering surface waters within the United States; amended to support municipal sewage treatment plants and establish time table for implementation of tighter controls on toxic pollutants; jointly administered by the U.S. Environmental Protection Agency and Army Corps of Engineering.

1972 - the first Conference on Human Development held in Stockholm, Sweden on June 5; representatives from 114 countries discussed the future of the environment, leading to the development of the United Nations Environmental Program and a declaration of June 5 as "World Environment Day."

1972 - use of the chemical DDT banned.

1972 - Illinois Endangered Species Protection Act - identified Illinois endangered animals.

1972 - Marine Research and Sanctuaries Act passed (federal).

1973 (amended in 1982, 1985, 1988) - Endangered Species Act administered by the Office of Endangered Species within the U.S. Fish and Wildlife Service; process to set aside or protect ecosystems, resources or species from harm with an emphasis on the ethical responsibility to plants and animals from a variety of viewpoints, including economic, aesthetic and ecological values of the species and the needs of society.

1973 - Organization of Petroleum Exporting Counties (OPEC) oil embargo and shutdown of oil production in Iran in 1979 led to oil shortages and sharp rises in the price of oil between 1973 and 1981; relative oil scarcity showed need for not wasting energy resources, especially oil.

1974 (1986) - Safe Drinking Water Act - established standards for drinking water and for protecting underground sources of drinking water from contamination.

1975 - Convention on International Trade in Endangered Species (CITES) - signed by 119 countries, listed 675 species that cannot be commercially traded as live specimens or wildlife products because they are endangered or threatened; established a system of import/export regulations to prevent the overexploitation of listed plants and animals.

1976 - Federal Land Policy and Management Act - gives Bureau of Land Management (BLM) first real authority to manage the public lands under its control.

1977 - President Jimmy Carter created the Department of Energy to help country deal with oil shortage.

1977 - Illinois Endangered Species Protection Act - amended to include plant species but did not provide protection given to animal species.

1977 - Pollution Control Act passed (federal).

1980 - Superfund Law passed requiring clean-up of hazardous chemical dump sites (federal).

1983 - Forest Development Act - created technical and financial assistance for management of privately owned forests.

1983 - refuge established around Julians Reef (14 miles offshore from Ft. Sheriden in Lake Michigan) to protect lake trout being released there.

1985 (1990 amended by Food, Agriculture, Conservation and Trade Act) - Food Security Act - included a "swampbuster" provision which stated that farmers who drain wetlands and plant crops on the area are ineligible for federal farm subsidies; included Conservation Reserve Program, taking millions of acres of the most erodible cropland out of production; administered by U.S. Department of Agriculture and Soil Conservation Service and state Department of Conservation.

1985 - Illinois Endangered Species Protection Act - amended to protect plants.

1986 - Emergency Wetlands Resources Act - directed the U.S. Fish and Wildlife Service to develop a National Wetlands Priority Conservation Plan to identify and rank federal and state wetland land acquisitions.

1990 - April 22 recognized as the 20th anniversary of Earth Day; 200 million people in 141 nations on all seven continents participated; largest global demonstration in history.

1992 - Environmental Summit in Rio de Janeiro, Brazil; President Bush refused to sign the agreement.

1994 - river otter reintroduced from Louisana to southern Illinois along the Little Wabash River.

Extensions:

1. Ask students to define what they would consider an environmental disturbance (natural) and an environmental disaster (human-caused). Do they consider one type to be avoidable and one an unavoidable occurrence? Does the role humans play influence how the occurrence is classified?

1811 - On December 16 an earthquake along the New Madrid Fault rerouted flow of Mississippi River.

1980 - On May 18 Mount St. Helens volcano erupted in southwestern Washington.

1983 - biggest forest fire on record burns four months in Borneo.

1986 - On April 26 an explosion occurred at the Chernobyl atomic power station in Ukraine (Soviet Union); worldwide concern for danger of nuclear reactions.

1987 - On June 16 the last dusky seaside sparrow died in a cage at Walt Disney World.

1988 - fires in Yellowstone National Park burn 989,000 acres.

1989 - On March 24 the Exxon Valdez Oil Spill occurred when a ship ran aground in Alaska's Prince William Sound.

1992 - Hurricane Andrew struck south Florida.

1993 - Mississippi River flood.

2. Using graphing techniques, show population trends in the United States and Illinois. Human and bison population levels are provided. Research other wildlife population trends and make comparisons.

People

Pre-1600 - 15 million Native Americans in the United States
late-1800s - 200,000 Native Americans in the United States
1800 - 1 billion people on earth
1930 - 2 billion people on earth
1975 - 4 billion people on earth
1989 - 5 billion people on earth
2029 - estimated 10 billion people on earth

It took the human population 2,000,000 years to reach the first billion. It takes an average of 11 years to reach each additional billion.

Bison

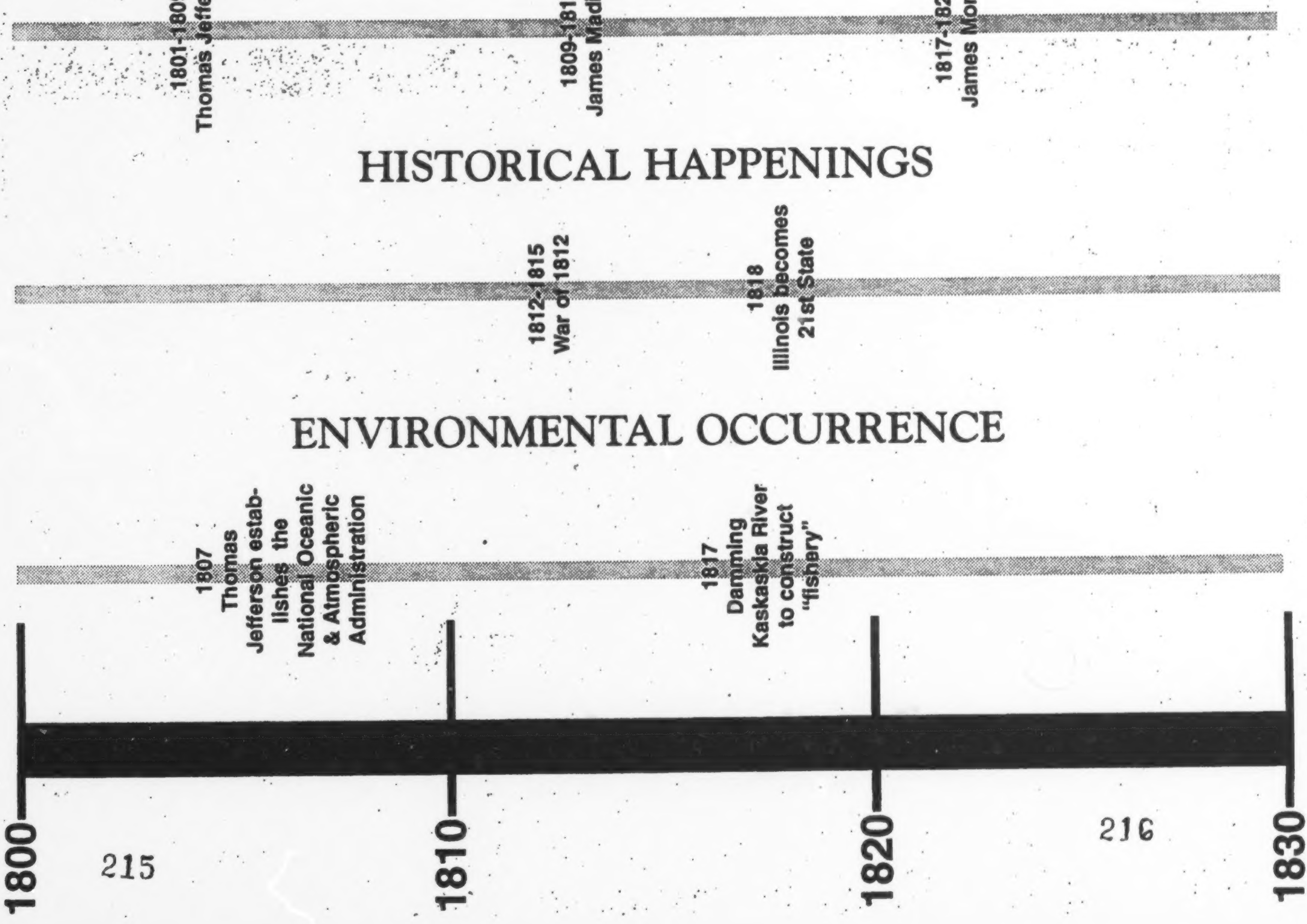
1860 - 50 - 60 million bison exist on the Great Plains
1880 - bison virtually extirpated from the Great Plains
1893 - protection of bison
1920s - bison herds managed for sustained population

Illinois Residents

	urban	*rural*
1870	596,000	1,944,000
1900	1,616,000	2,205,000
1910	3,480,000	2,159,000
1920	4,404,000	2,082,000
1930	5,636,000	1,995,000
1940	5,800,000	2,088,000
1950	6,487,000	2,226,000
1960	8,140,000	1,941,000
1970	9,230,000	1,884,000
1980	9,518,000	1,908,000
1990	9,669,000	1,762,000

3. Rather than depicting the historic information in linear style, have students prepare a cross-section of a tree. The "tree" should be large enough to show several hundred years. Draw circles representing the tree's annual growth rings. Label each circle with a year. Make a notation of the historical event(s) on the appropriate year.

SAMPLE



PRESIDENTIAL TERMS

1801-1809 Thomas Jefferson

1809-1817 James Madison

1817-1825 James Monroe

HISTORICAL HAPPENINGS

1812-1815 War of 1812

1818 Illinois becomes 21st State

ENVIRONMENTAL OCCURRENCE

1807 Thomas Jefferson establishes the National Oceanic & Atmospheric Administration

1817 Damming Kaskaskia River to construct "fishery"

1800

1810

1820

1830

PRESIDENTIAL TERMS

HISTORICAL HAPPENINGS

ENVIRONMENTAL OCCURRENCE

Resource
Conservation
Activity

Design A Resource Management Area

SUGESTED GRADE LEVELS: 7-12
SUBJECTS: Social Science, Science, Math, Language Arts
SKILLS: data collection, interpretation, mapping, communication, problem solving, decision making, role playing, reasoning, group process, construction, critical thinking, research, presentation, analysis, evaluation
CORRELATION TO STATE GOALS FOR LEARNING: Social Science (4), Science (1,2,4), Math (3), Language Arts (1,2,3,4,6)
RELATED ACTIVITIES: Mapping (Unit 4)

Objective: Students will use information gained from the education kit lesson plans to create a natural resource plan for a management area.

Background: Form teams of 4-6 students to design a resource management area. Copy and distribute blank "topographic maps" (pages 4-5) of a theoretical area. Students should decide which natural resources will be shown on the area and how they will be managed. The map scale can be adjusted to match the purpose of the management plan. Library research may be required to learn about selected habitats or species' requirements.

Students could elect to manage the area for timber production, create a fishing lake or park, develop or preserve a wetland, manage the area for river otters, protect an endangered plant or other uses of nature resources. Detailed descriptions are provided on five management options (pages 2-3). Two sample management plans are provided for review by the educator (pages 6-7). Students should be creative, exploring natural resource uses that interest them and applying principles learned from studies of natural resources.

Have students review the standard map symbols on page 8. Each map should include a legend, including the directional arrow and the symbols used on the map. Each team should select and note the scale and **contour** interval for their "topographic map." Suggested scale options are 1" = 10 miles, 1 mile or 1/2 mile. Suggested contour intervals are 10 ft., 50 ft. or 100 ft.

After completing their maps, have students make a presentation on their management plan. Presentations should include a summary of the research that led to specific features of the plan and a discussion of anticipated costs, environmental impacts and visitor use.

Evaluation:

- Develop a test using the standard map symbols.
- Evaluate written and verbal presentation of the plans.
- Evaluate the decision making techniques used or considered (consensus, legislative, regulatory authority).

Extensions:

- Using a telephone book, identify groups that would be involved in a land management plan (urban or land use planner, regulatory agency, citizen advisory group). Interview various groups to learn about federal, state and local regulations and projects in which they are currently involved.
- Create a flow chart of the actions required to implement the proposed land management plan, including the groups involved at each stage.
- Have teams exchange management plans. Ask them to review the plan and information from the oral presentation from the standpoint of a regulatory agency or as a group supporting or opposing the proposed action. Potential arguments could include the financial stability of the project, short vs long-term economic gains and impacts on critical wildlife habitat. Have the teams make presentations on their decisions to approve, disapprove, support or oppose the plan, including justifications.
- Calculate the total surface acres and volume of any lakes developed (using average depth).
- Review topographic maps to learn about the topographic features of an area near your school. Take a field trip to verify the features on the map.

Vocabulary: topographic, contour, scale, legend.

DEPICTED MANAGEMENT OPTIONS

Park and Lake Management Plan (page 6)
Goal: Using the topographic base map and information provided, design a multi-purpose recreational area for the public.

Background for Sample: Beginning in 1960, the state natural resource agency initiated action to acquire land and develop a management plan for a multiple-use state park in an area lacking any such facilities. In 1964, a dam was constructed in front of the Frog River just below Newt and Mud Puppy Creeks. This created a large lake shaped like a hand with three big fingers. A two-lane road was constructed to provide easy public access over the dam and around the lake.

The land between the fingers and to the north of the dam has been developed for a variety of outdoor recreational uses as well as wildlife habitat. To meet the needs of the public, a picnic area with playgrounds and softball diamonds was developed. The area directly north of the dam is managed as a secondary growth hardwood forest. The pasture to the west of the forest has been restored to native prairie grass.

Currently, fishing is allowed from the shoreline. Local fishermen have petitioned the agency for the creation of a boat access area.

Endangered/Threatened Species Management Plan (page 7)
Goal: Using the topographic base map and information provided, design a wildlife sanctuary for the river otter and bobcat.

Background for Sample: The river otter and bobcat depend on large, undisturbed watersheds for survival. Both species are present only in a few isolated locations in Illinois. The river otter is an Illinois endangered species and the bobcat is a threatened species.

However different in appearance and behavior, both species have many of the same needs. Clean water and prey species should be plentiful. The best habitat for each is steep, wooded bluffs, rolling hills and a bottomland forest next to a broad, slow-moving river and its backwater lakes and marshes.

Otters breed in the fall and give birth in February and March. Bobcats breed from February to April and give birth about 62 days later. River otters prefer hollow tree stumps, while bobcats give birth in a den or a hollow tree.

Consideration should be given to zoning the site for minimal human impact, especially during the mating and birthing seasons. Roads should be minimized and restricted to peripheral areas to maintain large blocks of undisturbed habitat. Consideration should be given to zoning trails used for birding to direct humans away from prime habitats during the spring. A low intensity forest or grazing plan could be implemented. To prevent unnecessary stress to these animals, a short educational program should be mandatory for every sanctuary visitor.

ADDITIONAL MANAGEMENT OPTIONS

Forest Management Plan

Goal: Using the topographic base map and information provided, manage an area to allow timber production and to maintain other benefits of forest communities, such as wildlife, water quality and aesthetics.

Background: Wooden Bridge Timber Company owns a section of land containing 640 acres. One perennial stream and two intermittent streams are found on the land. The perennial stream is located in the southwest quarter of the section. This managed forest area contains 160 acres of mixed even/uneven-aged trees. In July, a windstorm struck the upland area, damaging and felling many of the trees and destroying wildlife habitat. Regeneration of the area could occur naturally, by allowing seedlings and saplings to grow, or by direct seeding and planting of seedlings.

Points for consideration in designing a management plan for the area are allowing for a variety of activities to occur simultaneously with regeneration. For instance, timber skid trails could be developed for hiking and downed trees harvested for wood products. Timber along the perennial stream could be maintained for water quality and as a wildlife habitat corridor.

Housing Management Plan

Goal: Using the topographic base map and information provided, manage an area as an "earth-friendly" housing development.

Background: As a developer, you are interested in developing a tract of wooded land as a new housing development. The first house to be built will be the one that will become your retirement home. The sale of lots on the property will pay for your home.

You want to have some privacy during your retirement so you do not want the homes to be visible to each other. In addition, you plan to spend your free time walking through the woods looking for birds, mushrooms and wild flowers. You would like to spend some time fishing, but are not sure how to build a lake that will not be affected by sewage runoff from the homes. You are thinking you'd like to resume hunting, a sport you've not enjoyed since your youth, but are concerned about safety given the other homes and residents. Can you design a housing development to address all these concerns?

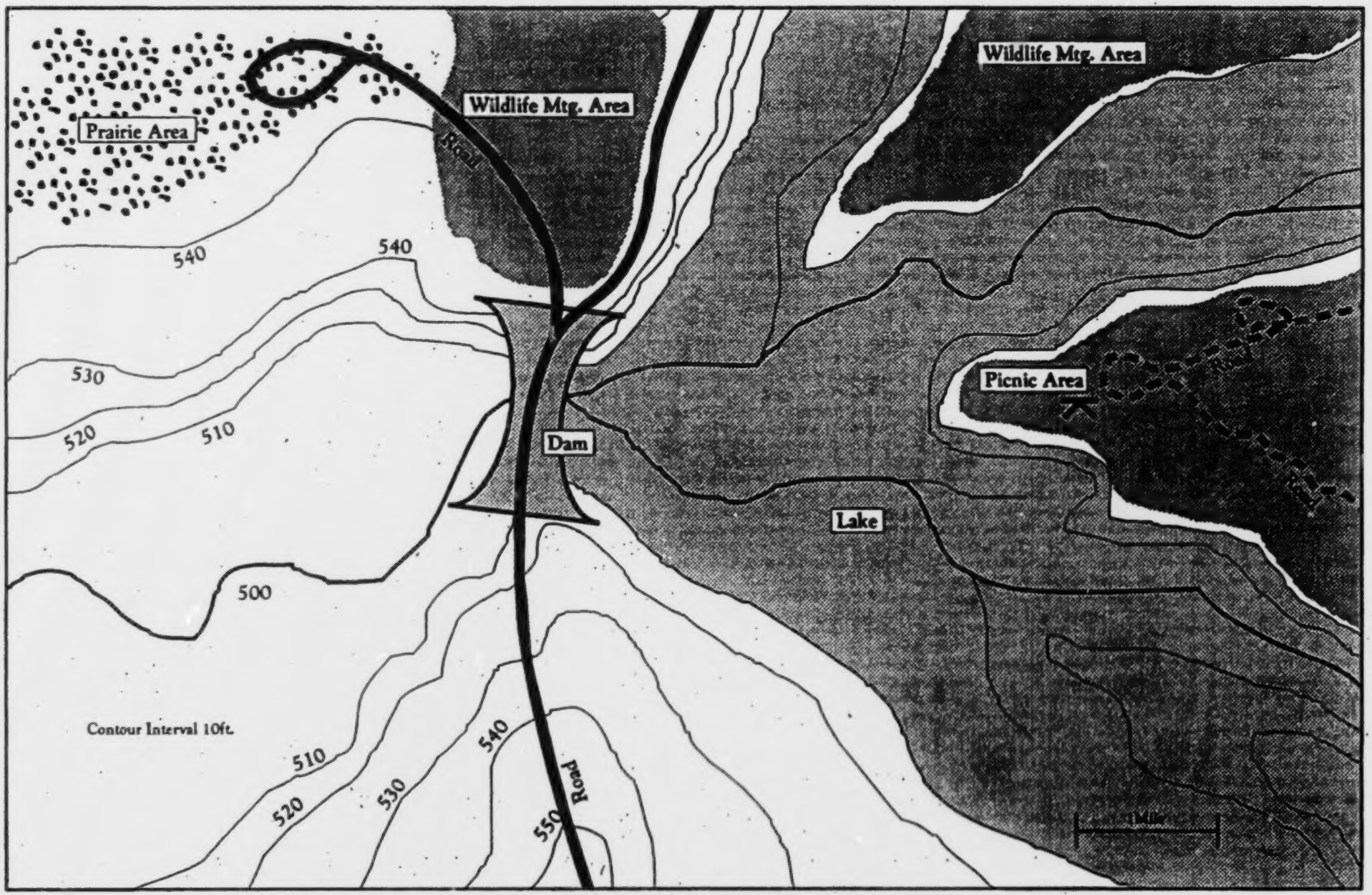
Commercial Fisheries Management Plan

Goal: Using the topographic base map and information provided, manage an area as a commercial fishing resort.

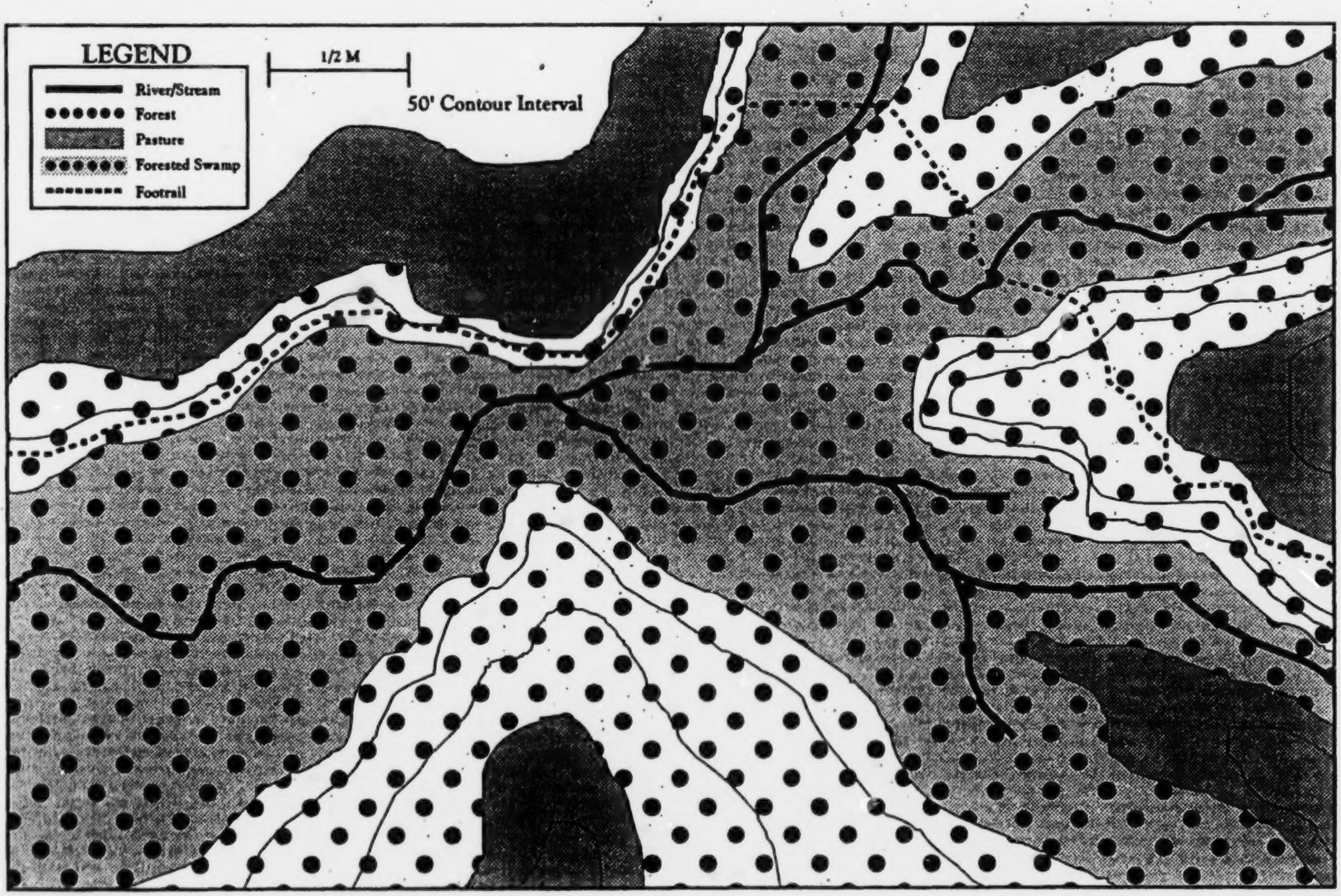
You recently acquired one of the most picturesque lakes in the state, and you decide to manage the lake to maximize fishing opportunities. All that is needed is a lodge for visitors and you're in business! You also realize that to attract families, activities other than fishing should be available. You are concerned that your cash-flow will be negligible in the winter and are looking for a cold-weather, income-producing venture.

You have hired a fisheries biologist to review the watershed and determine if adequate vegetation is present to prevent siltation. The biologist will also study the lake to determine the numbers and species present and assess habitat and food conditions.

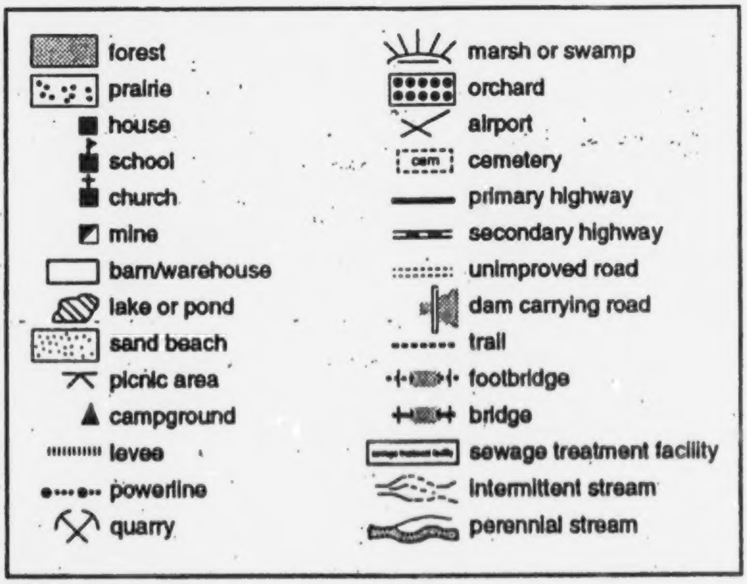
PARK AND LAKE MANAGEMENT PLAN


Prairie Area
Wildlife Mtg. Area
Road
Wildlife Mtg. Area
540
540
530
520
510
Dam
Picnic Area
Lake
500
Contour Interval 10ft.
510
520
530
540
550
Road
1 Mile

ENDANGERED/THREATENED SPECIES MANAGEMENT PLAN


LEGEND
River/Stream
Forest
Pasture
Forested Swamp
Footrail
1/2 M
50' Contour Interval

MAP SYMBOLS


forest
prairie
house
school
church
mine
barn/warehouse
lake or pond
sand beach
picnic area
campground
levee
powerline
quarry
marsh or swamp
orchard
airport
cem
cemetery
primary highway
secondary highway
unimproved road
dam carrying road
trail
footbridge
bridge
sewage treatment facility
intermittent stream
perennial stream

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Muehrcke, Phillip 1992. *Map Use: Reading, Analysis and Interpretation.* J.P. Publications, Madison, Wisconsin.

Riffel, Paul. 1973. *Reference Maps: An Introduction to Maps Using Color Stereo Photographs.* Hubbard Press, Northbrook, Illinois

TO ORDER MAPS

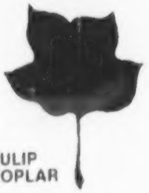
U.S. Geological Survey topographic maps:

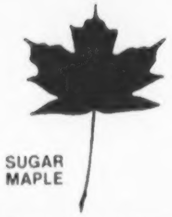
Illinois State Geological Survey, Natural Resources Building, 615 E. Peabody, Champaign, Illinois 61820-6924, 217/333-4747 or 244-0933.

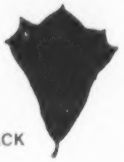
U.S. Geological Survey, 507 National Center, Reston, Virginia 22092, 703/860-6045 (areas east of the Mississippi River).

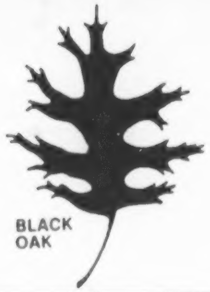
U.S. Geological Survey, Box 25286, Western Distribution Center, Federal Center, Denver, Colorado 80225 (areas west of the Mississippi River).

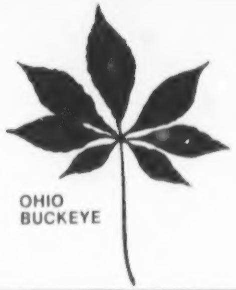
TAKE ACTION!

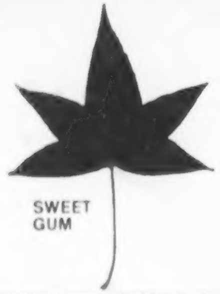

TULIP POPLAR


SUGAR MAPLE


BLACKJACK OAK


BLACK OAK


OHIO BUCKEYE


SWEET GUM

AT YOUR HOME

Plant native species of trees, shrubs and wildflowers. Remember to mulch the plants to reduce the need for weeding and to conserve water.

Minimize the amount of fertilizers and pesticides used. Attract insect-eating birds instead of using insecticides.

Maintain a bird-feeding station to attract birds to your yard. Be prepared for a great show!

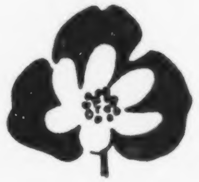
When shopping use cloth bags or reuse paper or plastic bags. When you buy a small item, tell the clerk that you won't need a bag. Look for items that have minimal packaging or have been produced from recycled material.

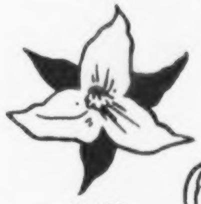
Pack waste-free lunches for school and picnics.

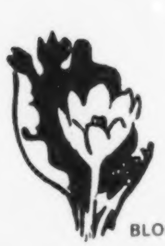
Use low-flow shower heads and shorten the length of your showers.

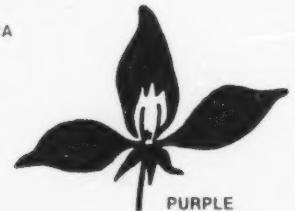
Instead of taking the car on short errands, walk or ride your bike.

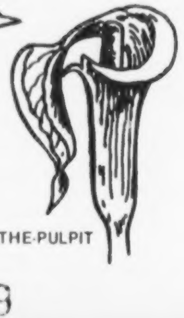
Instead of throwing everything away, look at it carefully and see if you can recycle it. Remember to recycle paper, plastics, aluminum and glass. Think of other means of "recycling." Could your old toys be fixed and donated to a day care center? Could the clothes you have outgrown be sent to a charitable organization?


HEPATICA


WHITE TRILLIUM


BLOODROOT


PURPLE TRILLIUM


JACK-IN-THE-PULPIT

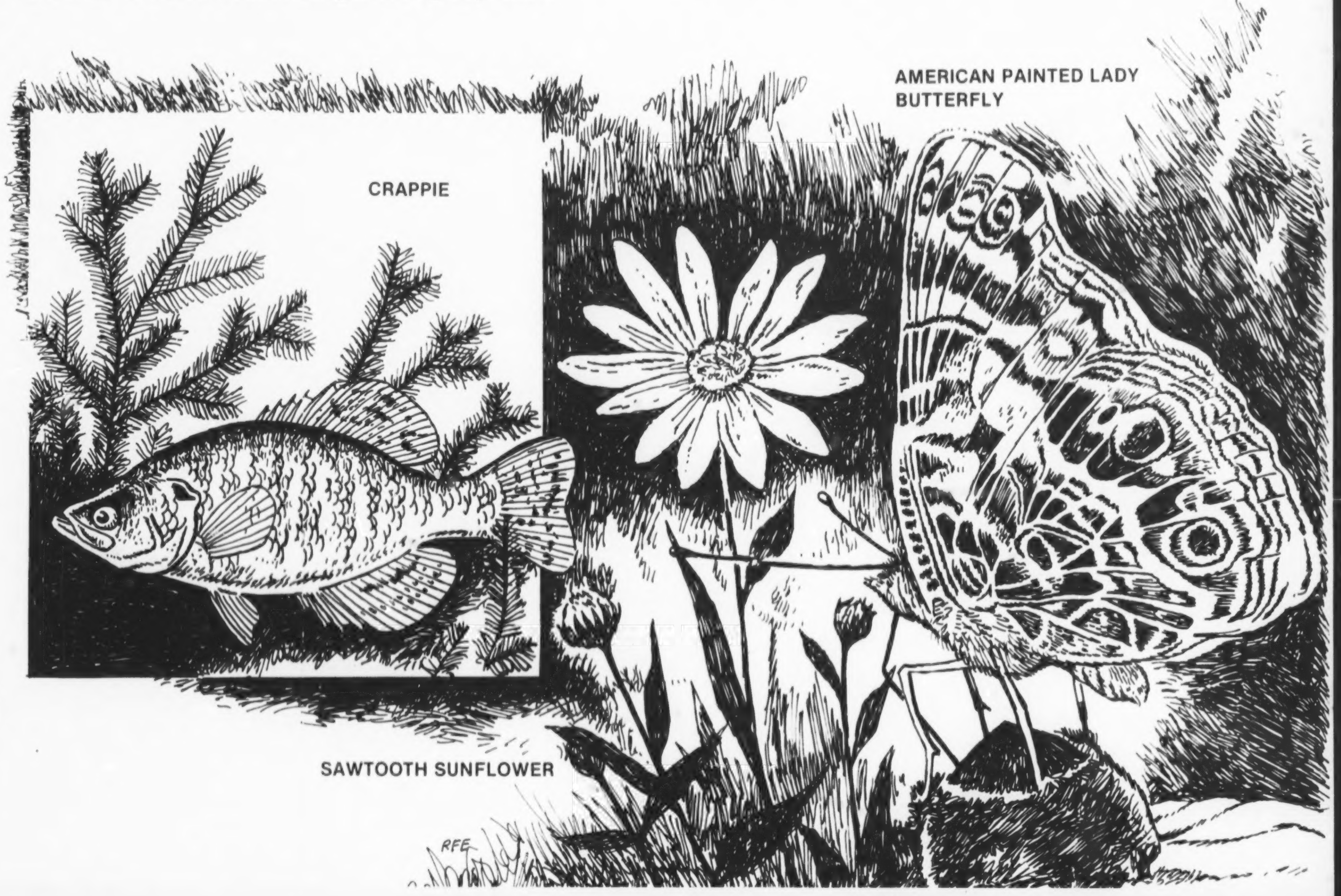
IN YOUR COMMUNITY

Work with others to develop a community garden or prairie or butterfly garden.

Volunteer to assist with a project to clean up a stream, lake or vacant lot.

Volunteer to assist a land management agency with a project to control exotic plants, reforest an area or develop and maintain a trail.

Start a project to collect Christmas trees to construct brushpiles for wildlife or to sink in a local lake to produce fish habitat.



TAKE ACTION!

AT YOUR SCHOOL

DOWNY GENTIAN

TULIP POPLAR

PALE PRAIRIE CONE-FLOWER

PIN OAK

CRAB APPLE

BLACKJACK OAK

Get involved! Join your school ecology club. Don't have one? Work with others that share your interests to locate a sponsor and start a club.

Conduct a survey of the students and teachers in your school to learn what they feel are the most serious environmental issues today. Then take action!

Invite a natural resource professional to your school to talk about his/her career.

Keep the Earth green. Work with your teachers and school administrators to develop wildlife habitat on school property.

Organize an event to celebrate Earth Day, Arbor/Bird Day or Natural Resources Stewardship Month (April).

Organize a natural resource poster, essay, photo or video contest. Ask a panel of judges to select the entries that depict a specific theme such as "Wildlife Habitats," "Wetlands," or "People Working for the Earth."

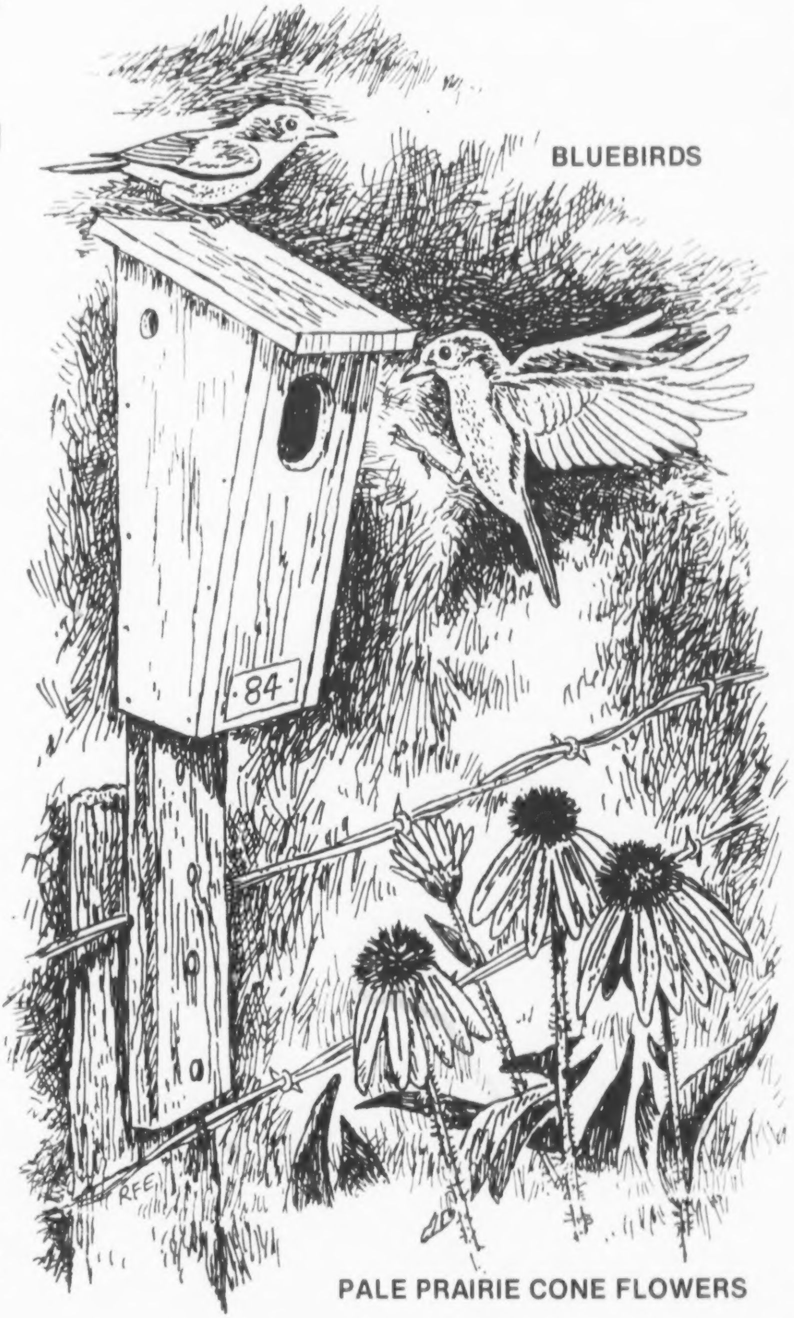
As a school project design and build bird feeders or nest boxes. Distribute the completed projects to local nursing homes or day care centers.

Learn about local efforts to monitor the quality of rivers and streams. Ask your school to get involved!

Conduct an energy audit of the school. What steps can you take to make the building more energy efficient?

Think that recycling is a concept unique to humans? Think again! Check for signs of wildlife recycling such as birds or animals that reuse nests or dens or worms and other decomposers that convert plant material to soils.

Start a campaign in your school to reduce, reuse and recycle appropriate materials.


BLUEBIRDS

PALE PRAIRIE CONE FLOWERS

Pass the word! Talk to others — teachers, students, parents, media, community leaders, youth groups — about what you are doing to help the environment and how they can help.

Write to government officials to tell them what you are doing to improve the environment. Suggest ways that you would like to see them help.

GET CONNECTED

For additional information contact these and other organizations:

IN ILLINOIS:

Illinois Association of Soil and Water Conservation Districts
40 Adloff Lane, Suite 2
Springfield, Illinois 62703

Illinois Cooperative Extension Service
122 Mumford Hall, 1301 West Gregory Drive
University of Illinois
Urbana, Illinois 61801

Illinois Department of Conservation
524 S. Second Street
Springfield, Illinois 62701

Illinois Department of Agriculture
State Fairgrounds, P.O. Box 19281
Springfield, Illinois 62794

Illinois Department of Energy and Natural Resources
325 W. Adams, 3rd Floor
Springfield, Illinois 62704

Illinois Endangered Species Protection Board
524 S. Second Street
Springfield, Illinois 62701

Illinois Environmental Protection Agency
2200 Churchill Road
Springfield, Illinois 62706

Illinois Natural History Survey
172 Natural Resource Bldg.
607 Peabody Drive
Champaign, Illinois 61820

Illinois Nature Preserves Commission
524 S. Second Street
Springfield, Illinois 62701

IN THE NATION:

Agricultural Stabilization and Conservation Service
P.O. Box 2415
Washington, D.C. 20013

American Forestry Association/Global ReLeaf
P.O. Box 2000
Washington, D.C. 20010

National Audubon Society
950 Third Avenue
New York, New York 10022

National Arbor Day Foundation
100 Arbor Avenue
Nebraska City, Nebraska 68410

National Wildlife Federation
1412 16th Street, N.W.
Washington, D.C. 20036

The Nature Conservancy
1815 North Lynn Street
Arlington, Virginia 22209

Renew America
1400 16th Street, N.W., Suite 710
Washington, D.C. 20036

Soil Conservation Service
P.O. Box 2890
Washington, D.C. 20013

U.S. Environmental Protection Agency
401 M. Street, S.W., A 108
Washington, D.C. 20460

U.S. Fish and Wildlife Service - Publications Unit
130 Arlington Square Building
18th and C Streets, N.W.
Washington, D.C. 20240

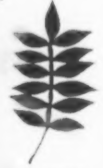
U.S. Forest Service
P.O. Box 96090
Washington, D.C. 20090

SWEET GUM

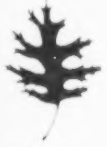
HICKORY

SUGAR MAPLE

OHIO BUCKEYE


SHINING SUMAC

SYCAMORE

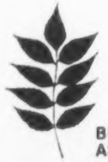

BLACK OAK

BUR OAK

RED MULBERRY

POST OAK

TUPELO GUM


BLUE ASH

JACK-IN-THE-PULPIT

HEPATICA

BUTTERCUP

PURPLE TRILLIUM

WILD GERANIUM

BLUE VIOLET

WHITE TRILLIUM

WHITE VIOLET

RUE-ANEMONE

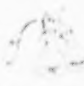
SPRING BEAUTY

YELLOW VIOLET

BEECH

CHESTNUT

WHITE OAK


BLUEBELLS

YELLOW BELLWORT

PURPLE OXALIS

BLUE-EYED MARY

WILD PETUNIA

BLOODROOT

Conservation Education Program

Resource Conservation

ACKNOWLEDGEMENT RECEIPT

Affix mailing label here

Please provide the following information and return this form to the address below. Completion and return of this RECEIPT will place your school on our computerized system for updates to *Resource Conservation* and notices of the availability of other conservation education materials developed by the Conservation Education Program.

IF WE DO NOT HAVE YOU ON FILE AS A RECIPIENT OF A KIT, YOU WILL NOT BE ABLE TO OBTAIN UPDATES OR REPLACEMENT MATERIALS FOR YOUR KIT. Please take the time to complete and return this form for your school.

Thank you for your cooperation and continued interest in educating our youth about Illinois' natural resources.

(please type or print)

NAME ____________________

SCHOOL/CENTER ____________________

ADDRESS ____________________

CITY ____________________ ZIP ____________________

TELEPHONE NUMBER (______) ____________________

COUNTY ____________________

____________________(name, title) has been assigned to coordinate utilization and check-out of the *Resource Conservation* education kit at the above educational/attendance center.

DATE ____________________

PLEASE RETURN THIS FORM TO:

Illinois Department of Conservation
Conservation Education Program
524 S. Second Street
Springfield, IL 62701-1787

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DEPARTMENT OF AGRICULTURE

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